AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 3, No. 8. WEEKLY. | NEW YORK, FEBRUARY 21, 1880. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

Practical Blacksmithing.—Forges and Tuyeres for Light Work.

BY FREDERICK LEWIS.

In fitting up a blacksmith's shop the first consideration, after the building has been erected, is to decide upon the style and location of the forge. This, of course, depends upon the nature of the work to be done, whether it be light or heavy. If for light work, the bottom blast is generally used, while for heavy work the side blast is found to be the best. I will describe the manner of building a forge for light work, which, I think, will give general satisfaction. Many blacksmiths are to be found, who still adhere to the old-fashioned brick forge, and claim it to be the best, but if they could work for only one day on a forge like the one shown in Fig. 1, they would never again utter a word in favor of a brick forge. The forge shown in the illustration referred to, is not expensive and is easily made. The size for general light work is from 58″ to 60″ square, and from 18″ to 20″ high. The four sides *a*, are made from No. 14 iron, which are strongly riveted to 1¼″ angle irons *b b*, placed at the corners. The front sheet is removed to show the manner of setting the tuyere *C*, which is a cast-iron box with a slide at the bottom. It has a thick top, which projects about 3″ beyond the box on each of the four sides. A brick pit should be built of single rows of bricks, forming the two sides *d d*, and the back end. The tuyere should be set 24″ from the front side to the center, and 10″ from the plate *f*, and in height, so that the top may be at least 5″ below the top of the forge, in order to allow for a good thick fire when needed, to prevent the cold air from striking the hot iron. Many blacksmiths work at a continual disadvantage, when a little good judgment and common sense in the construction of the forge would have saved the constant vexations caused by bad welds. When a fire is too shallow, the least dirt will form a clinker, which will interfere with the blast, or stop it altogether.

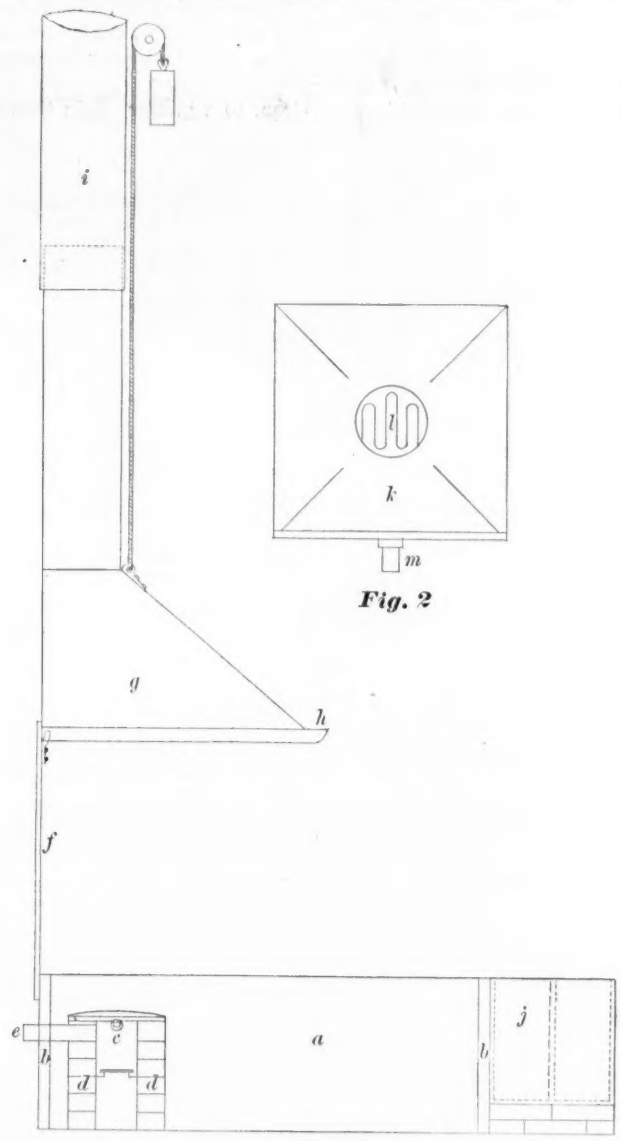


Fig. 2

Fig. 1

A plan of the tuyere is shown in Fig. 2, where *k* represents the top plate with a hole in the center about 3″ in diameter. A cast-iron ball attached to a stem *m*, with a square end, is generally used on this pattern of tuyere. This ball does not fill the hole, but has a space for the air to circulate all about it, while in the center is a rectangular hole about ½″×2″. By turning the ball half a revolution, a round hole is presented which concentrates the blast, and delivers it at only one point. This and other patterns have been used extensively, but, after years of experience with all kinds of tuyeres, I know an old blacksmith who has settled down upon the plan shown in the engraving, which is a cast-iron form having three projections *l*, which reach across the hole. The openings between these projections are made wider at the bottom, so that any dirt which will pass the top will fall through. This plan gives a good blast, equally distributed, and insures good combustion. The front sheet of the forge should have a hole cut in it, through which the dirt from the tuyere may be removed. This hole should be no larger than actually required. After setting the tuyere, the forge should be filled with good clean coal dust, or fine clinkers (some use both), as the dust is a non-conductor of heat, and the clinkers will not stick to the work. Bricks and fire clay should be kept away from the fire, as many difficulties appear in working metal, which are in reality caused by the slag and dirt from bricks or fire clay, but are generally attributed to other causes.

No more bricks should be used about the forge than are shown in the engraving.

A plate *f*, is bolted to the forge, which forms a screen, and at the same time a support for the hood *g*, by means of two hooks at the top. The hood referred to is made from No. 16 galvanized iron, which is preferred to common iron, from the fact that the chemical action of the gas, and the weather, will, in a short time, destroy common iron; moreover, the soot and dirt will not stick to galvanized as readily as to common iron.

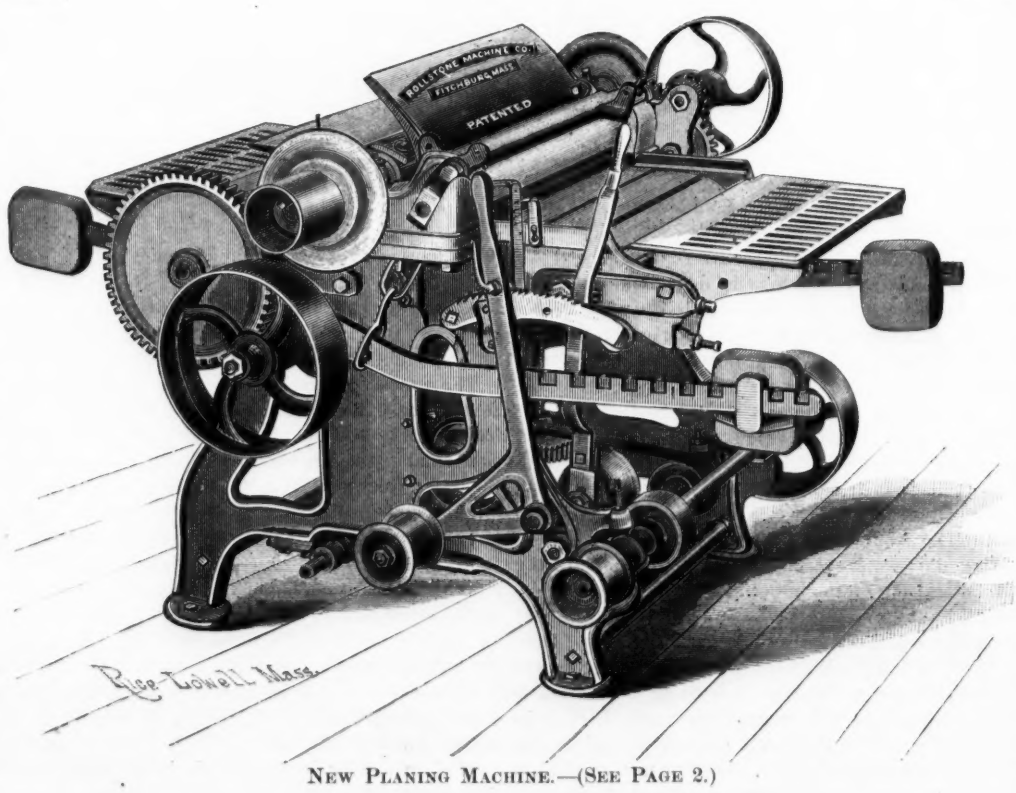
The bottom of the hood *g*, is about 3 feet square. To the top of this is attached a pipe 10″ in diameter. This pipe fits easily into another pipe, *i*, and being counter-balanced by a weight and chain, may be readily raised and lowered 3 feet, or less, as occasion may require. I have no knowledge of this device having been in general use, and therefore it may be new to some of your readers. The advantages of it may be seen at once, as in the case of welding tires, or large work which interferes with the hood. Another noticeable feature is the forming of a flange or gutter *h*, on three edges of the hood, as shown. The object of this is to catch all the soot and dirt which drops from the pipe, thus preventing it from falling upon the workman and forge. An iron water and coal box *j*, is to be placed at the end of the forge, the dimensions of which are 16″ wide by 16″ deep, and 58″ to 60″ in length. It has a partition running lengthwise through the center, thus leaving the space nearest the forge for coal, and the other for water.

The practice of using buckets and tubs about a blacksmith shop should be condemned, for obvious reasons.

Having finished the forge, we will now turn our attention to the problem of furnishing the blast.

Many plans and designs of apparatus have been proposed, and adopted in different localities. Both these and the old fashioned double bellows have their friends. For general light work I prefer the old bellows, as they have advantages which the others have not, one of which is that they will continue to blow for some time after the lever ceases to work.

In heating small work, when one piece of iron is taken from the fire and another inserted, by giving the bellows lever several strokes, the blast will continue long enough to heat the iron in the fire, while the other is being worked upon the anvil. The old leather bellows have stood the test for a great many years, being first recorded as used in the time of Thothmes III, 1490 B C., and are now represented on a tomb, bearing the name of that Pharaoh. They consisted of two bags, which were worked by the feet and hands, by throwing the weight upon the feet, and lifting them alternately, by a cord in each hand. The bellows, as used in its present form, was early known to the Greeks and Romans, and having given satisfaction all these years, I believe that it will be a lon time before it will be superseded for light work.



NEW PLANING MACHINE.—(SEE PAGE 2.)

Various machine-worked bellows have been invented in which the pulsating motion has been abandoned and a rotary motion introduced. These are called blowers. It is much easier to work a lever than it is to turn a crank, and, when the power applied to turn the crank ceases, the wind also stops. Therefore, with all blowers of this class, it is more necessary to have the constant attention of a helper.

There is much discussion as to the manner in which a bellows should be hung. The writer believes that, practically, a bellows should be hung on a level with the forge, or, in other words, the bottom board, when hanging naturally, ought to be on a level with the nozzle, as gas is less liable to be drawn back into the bellows when hung in the manner described. If there is anything that will make a blacksmith indignant, it is to have gas accumulate in the bellows; moreover, it is very dangerous, as I have known bellows to explode by the gas igniting from the fire, thereby inflicting serious injury. The top board of the bellows, being divided into two parts by a strip fastened across it, the back part is used as a cabinet for the reception of small specimens of iron, steel and broken tools (which are kept for a reason which no one can explain), and, in fact, everything that is to be saved, while the other part is used by the boss as a drawing board, upon which to draw designs and jot down orders, with directions, as they are received from the customers.

Some blacksmiths advocate the plan of elevating the bellows from eight feet to ten feet above the floor, to save room and to get better results, but I fail to see where the economy is. First, it costs more to hang a bellows in this manner. Second, the joints of the tin pipe, which is usually employed, will, by being subjected to continual vibrations, work loose. Considering the fact that the air, instead of having a short, straight passage into the fire, has to turn two right angles, thus losing a portion of its force through a long pipe with leaky joints, I believe that this plan of hanging a bellows is extravagant. When a bellows is elevated, it is more liable to accumulate gas, and the leather is more rapidly destroyed, than when on a level with the forge.

One of these patent-right men came to the shop, the other day, and made the bold assertion that he could beat my old bellows all hollow. The arguments ran high, and both sides thought themselves victorious. Finally a trial was fixed upon, and, after the necessary preparations, we began the test between the old double leather bellows and the patent blower. The result was, that, in a day's work of ten hours, I averaged three $\frac{3}{4}$" bolts forged to his one, and I can do it every time on light work; but, when the iron is over $1\frac{1}{8}$" in diameter, then I will give way to a good fan blower.

A New Planing Machine.

The cut on first page shows a planing machine made from entirely new patterns, and embodying some desirable improvements. The general construction is apparent at a glance. It has double balance wheel driving pulleys on the cutter head, and both the cutter head and journals are made of steel forged together in one piece, and finished with ground journals $1\frac{7}{8}$ inches diameter, which run in self-oiling boxes. These are adjustable for dressing from $\frac{1}{4}$ to $7\frac{1}{2}$ inches thick, by means of a new frictional adjuster, which works entirely by power, and is claimed to be quick, accurate and durable. The machine has double pressure rolls, the front and back rolls being weighted, and the entering roll geared, which, together with the revolving lag bed, make a very powerful feed, which, it is claimed, will not fail on wet, pitchy or icy lumber. The revolving bed runs over steel ways, and is close jointed and extra heavy. The whole planer is very heavy, and is very nicely made from the best stock. All the journal boxes are lined with babbitt metal. Three sizes are made, planing 22", 24" and 27" wide. The capacity is from 3,000 to 4,000 per hour. They are adapted to the work of ship yards, car shops, lumber mills, cabinet and furniture shops, and all kinds of light and heavy surfacing where nice, smooth and rapid work is required. The manufacturers are the Rollstone Machine Co., Fitchburg, Mass.

Boilers for Marine Use.

BY H. L. STELLWAGEN, M. E.

Space is of great consideration on board all vessels, and it is very desirable to obtain a boiler which will occupy the least possible compass, yet designed to give the best results consistent with safety, durability and economy.

Safety depends greatly upon the quality and strength of material, and on mode of construction.

Durability depends upon the requirements for safety, but more particularly on the facilities afforded for cleaning and repairing.

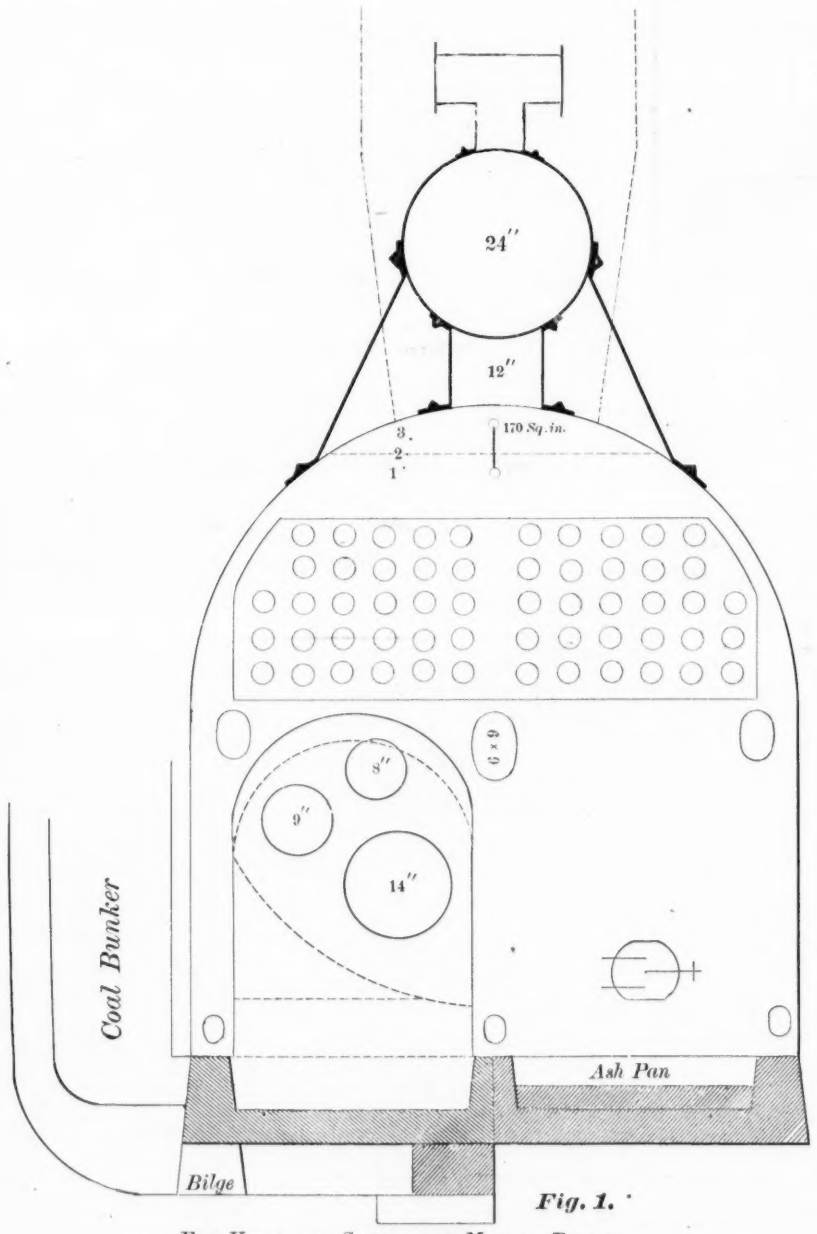


Fig. 1.

End View and Section of Marine Boiler.

Economy, while the result of all the above qualities combined, is dependent in a far greater measure upon the design.

In the construction of marine boilers, the joints must have especial care and good workmanship. They are either single or double riveted. The holes should be punched the proportionate distance apart, and correspond exactly with each other, so that neither reaming nor drifting is required, thereby avoiding unequal strains. Where the sheets overlap horizontally, it is best to have the edges next the water facing upward, to facilitate the raising of steam bubbles to the surface.

At present most boilers built for steamboat service, owing to their great diameters, have the longitudinal seams double riveted, except in cases where the pressure to be carried is very low. There are three methods of uniting boiler plates, viz.: Machine, and hot, or cold hand, riveting. The first mode possesses the greatest advantage and should be adopted wherever possible. In forming the heads by hand riveting, the work is not so thoroughly done, and the metal (especially by the cold process) is apt to become brittle from repeated hammering. There does not seem to be any particular advantage derived from either the hot or cold hand process, each having about equal merit when well done.

The strongest boilers are those composed of tubes and cylinders, that form being best adapted to internal pressure. Flat surfaces should be avoided as much as possible, being weak and unsafe; it is, however, difficult to build a marine boiler without them, owing to its peculiar shape, and where they do occur it is necessary to strengthen them with braces and stays, about one square inch of section of brace (when of copper) being allowed for every square foot of plate subjected to a strain per square inch of not over 20 pounds of steam. Where higher pressures are to be carried, the braces or stays must, of course, be more numerous, a safe rule being, not to subject each brace, when of iron, to a greater strain than 8,000 pounds per square inch of section, and when copper, to not over 3,000 pounds.

All angles, irregular surfaces, crowns and sides of furnaces, tube-sheets, stays and braces, ought to be of the very best material.

The tubes for marine boilers are usually from 2 to 4 inches diameter, according to length; it is best to place them in vertical rows, and as they increase in size, so should the spaces between them, to admit of a free circulation.

They are secured and made tight in the tube sheets by two modes—viz., riveting and rolling. The former has the advantage, inasmuch as the riveted ends are a great support to the sheets. For the latter, the only advantage claimed is the facility with which it is done. Where this process is used, the tube sheets must be well braced, as rolling affords but little support.

Modern marine boilers are designed with from twenty to thirty square feet of heating to one square foot of grate surface, the grate being not over six feet in length, and consuming not over 14 pounds of coal per square foot, and evaporating from 5 to 12 pounds of water per pound of coal. The evaporating power depends greatly upon a due and perfect proportion of the furnaces and on the quantity of flue surface in contact with the heat. In the horizontal fire-tube boiler, or the return tubular with flues, from $1\frac{1}{2}$ to 2 square inches of area should be allowed over bridge, or through flues, for each pound of coal consumed per hour per square foot of grate, and the area of tubes ought to be from $\frac{1}{8}$ to $\frac{1}{4}$ of the grate surface, according to the amount of coal to be burned, for a natural draught. The crown sheets should be round or oval, and not less than 18 inches above the grate, as a high furnace is favorable to quick combustion. The bars must decline towards the back of the furnace. The depression being about one inch in twelve, their width or thickness ought to be the least practicable, and the spaces between them from $\frac{1}{2}$ to $\frac{3}{4}$ inch, according to the kind of fuel used. It is important to have both water space and steam room properly proportioned, and care should be taken, in the selection, that the water space is not diminished by an undue number of tubes and flues. A boiler, to give satisfaction, will depend as much upon a sufficiency of water from which to generate steam as upon the heating surface to evaporate it, and, when the latter is increased at the expense of the water, the result is not at all gratifying. The amount of water should exceed the evaporation in a given time, so that the supply of feed may not greatly reduce the temperature of that already in the boiler, and check the formation of steam. It ought also to be arranged of sufficient height, so that the fire surfaces are in no danger of becoming bare, either from the rolling of the vessel or neglected feed. The space allowed for water should be from three to five times the evaporation, and that for steam about $\frac{2}{3}$ the evaporation. The latter space must always be amply large to avoid priming.

There are many boilers in use, at present, with so little water space and steam room that, when the water is carried high enough to generate sufficient steam, the latter space is so diminished that, on the pressure being relieved at each stroke of the engine, water is carried with the steam to the cylinder. On the other hand, when the water is lowered to avoid that difficulty, it frequently happens that there is an insufficiency of steam for want of a proper quantity of water to generate it. Many boilers, likewise, are constructed with area over bridge wall and through tubes too much contracted to afford a free passage for the products of combustion, causing a sluggish draught and greatly diminishing their efficiency. It is to be regretted that so many vessels are supplied with motive power in this limited manner, as the anxieties and labor of engineers and firemen are greatly multiplied, and the wear and tear of the boiler increased.

To render the foregoing remarks plain and comprehensible, I herewith furnish a sketch and give dimensions of a marine boiler which (from many years experience with the faults and advantages of those in present use) will, I think, give satisfactory results. It is intended to carry a pressure of 75 pounds, and supply steam for a cylinder 15" $\times$ 18," cutting off at ten inches of the stroke, with a piston speed of 270 feet per minute.

This boiler is of the class of those found in aowing and non-condensing freight steamers, is calculated to burn from 10 to $11\frac{1}{2}$ pounds of coal per hour, per square foot of grate, and to evaporate 45 cubic feet of water with a natural draught. Both evaporation and consumption of fuel can be increased, however, by using the exhaust in the stack as a blast.

Figs. 1 and 2 represent the front and side views. It is of the horizontal return fire-tube type; length of shell, 12 feet; diameter, 78 inches, with a heating surface of 682 square feet, which, being divided by 15, the number of feet required, according to fuel burned, to evaporate one cubic foot of water, gives a total evaporation of about 45 cubic feet per hour.

It has two furnaces, each 5 ft. by 2 ft. 8";

extreme height of crowns above grate in front, 33 inches, increasing to 42 inches at back, owing to crowns rising three inches and the depression of the grate bars. The grates together contain 26⅔ square feet; each furnace has three flues of 8, 9, and 14 inches respectively, their total area in both furnaces, about 536 square inches, being an allowance for the escape of the products of combustion of 20 square inches per square foot of grate, or 2 square inches per pound of coal burned per square foot. There are 56 four-inch tubes, the inside diameter, $3\frac{9}{14}$ inches, which convey the gases from back to front connection, their combined area being about the same as that of the flues, affording a free passage to the smoke stack, the area of which, at its base, is 572 square inches, increasing to 1,018 square inches, three feet above the boiler. The height of stack is about 25 feet, or eight times its largest diameter, having a damper for regulation of the draught.

The contents of front connection is 29½, and that of back connection 43 cubic feet. The tubes are placed vertically 5 inches, and horizontally 5½ inches from centers, with spaces of four inches between them and the shell, another of 4½ inches in the middle, the three passages admitting of a free circulation. The water line is nine inches above the top row of tubes, which is sufficient to prevent them from ever becoming bare. The amount of water contained in the boiler is 191 cubic feet, being four times the evaporation, and is about 7⅛ cubic feet for each square foot of grate.

The steam room is 32⅛ cubic feet, a little more than ¼ of the evaporation, as follows: contents of segment above water line 13⅛ cubic feet—steam drum 6 feet long, 24 inches diameter, 19 cubic feet—making the above result of 32⅛ cubic feet. This type is in general use for marine purposes, and when well made will last from 8 to 10 years; repairs being needed after from 2 to 4 years' service.

There are some water tubes in use, but mostly in the navy. This design presents a few advantages over the fire-tube, among which is their capacity for containing water and steam, great amount of heating surface, large grate, with sufficient area for consuming any number of pounds of coal required per square foot. This type of boiler has somewhat the same outward appearance as the fire-tube, but is not the sectional water tube, which is a design not suitable for marine use.

Owing to the manner of contracting, by many persons, and the limited space for boilers to which makers are confined, may be traced the unsatisfactory results obtained in most cases; often the only requirements given in a contract are size of cylinder, quality of iron, and the pressure to be carried, the most important points being left entirely to the builder. This is certainly a very unsatisfactory method of doing business, as it opens a way for unjust competition by enabling one maker to furnish a boiler wholly inadequate for the purpose desired, for a much less sum than another could afford, who was anxious to do what was right and proper for the occasion. If in requiring estimates, dimensions and specifications were given, there could be but little difference in prices, as each maker would be obliged to furnish exactly what was stipulated for, and the purchaser could select the design presenting the most advantages.

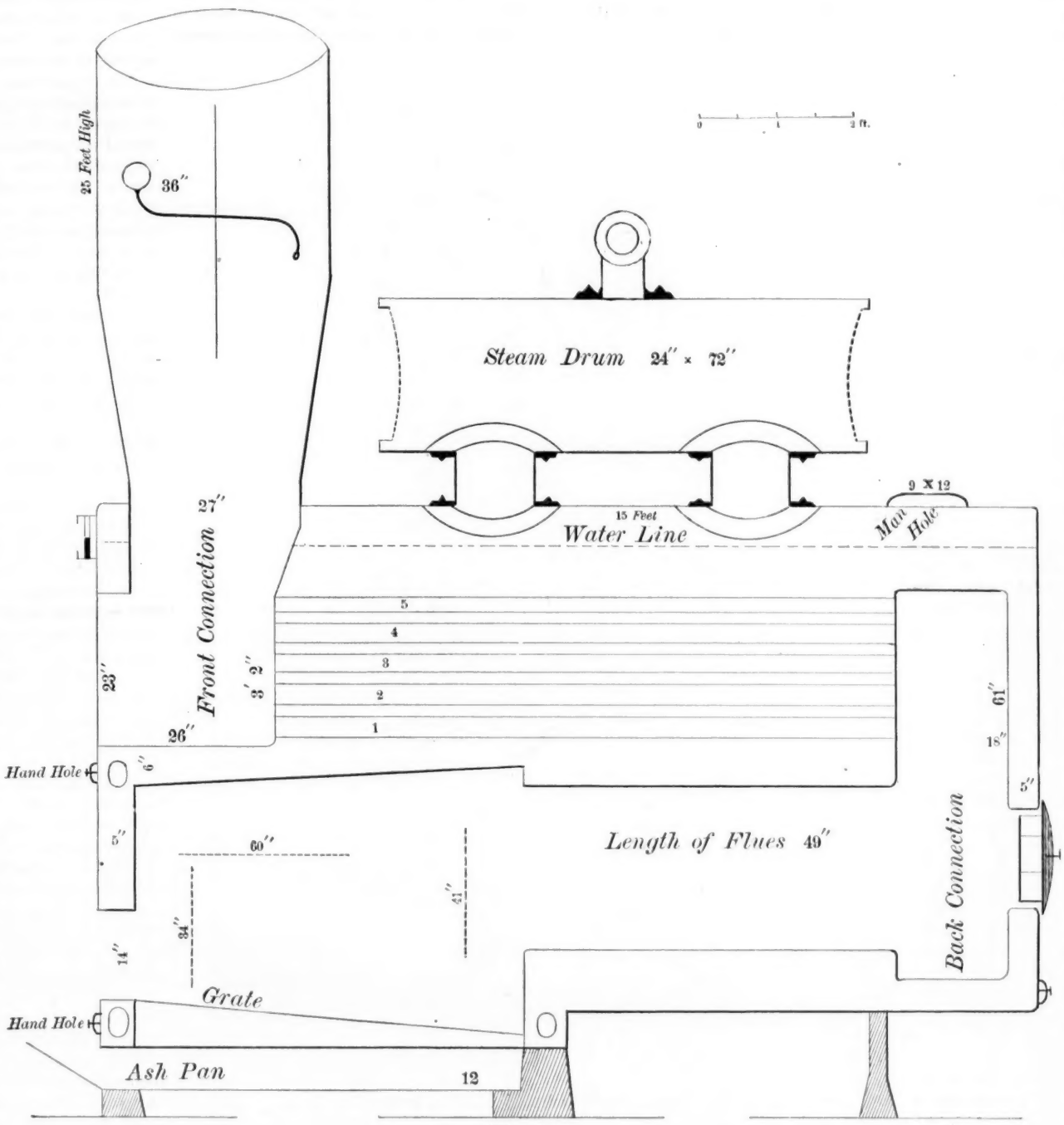


Fig. 2.
LONGITUDINAL SECTION OF MARINE BOILER.

Locomotives for Canal Boats.

Locomotives are used on canal towpaths in France. They are of light build, not weighing over four or five tons, and are managed easily by one man. Barges are thus drawn at a speed of two miles an hour, about twice the mean rate of a horse on the towpath. Any empty vessel is drawn six miles an hour, but a greater speed would damage the banks of the canal. Many efforts have been made to induce the New York state legislature to authorize the running of light locomotives on the towpath of the Erie Canal, but opposing interests have always defeated this measure whenever introduced.

Preserving Wood with Lime.

The improved French method of preserving wood by the application of lime is found to work well. The plan is to pile the planks in a tank, and to put over all a layer of quicklime, which is gradually slaked with water. Timber for mines requires about a week to be thoroughly impregnated, and other wood more or less time, according to its thickness. The material acquires remarkable consistence and hardness, it is stated, on being subjected to this simple process, and the assertion is made that it will never rot. Beechwood prepared in this way for hammers and other tools for ironwork is found to acquire the hardness of oak, without parting with any of its well-known elasticity or toughness, and it also lasts longer.—*American Building News.*

Cutting Screw Threads in a Lathe.

BY J. E. MCCONNELL.

Much has been written about screw cutting, and many machinists after reading a great deal that has been published, know no more than they did before. I give herewith some plain practical directions.

To determine what gears to use, take the number of threads to the inch which the lathe will cut with even gears (gears of same size on stud and screw), for the number to be used on stud, and take the number of threads per inch desired to be cut, for the number to be used on screw; or any other numbers which are in the same proportion to each other as these two. For example: The lathe cuts 3 threads per inch with even gears, and we desire to cut 7. We use gears on stud and screw, which are in proportion to each other, as 3 to 7; as 18 and 42, 24 and 56, 30 and 70, 36 and 84, and so on.

When the stud makes the same number of revolutions as the spindle (which is the case with most lathes), the lathe will, with even gears, cut screws of the same pitch as the lead screw.

In cutting a double-threaded screw, it is best to change alternately from one thread to the other, if convenient; especially so with the finishing cuts. This can be done by opening the nut and moving the carriage, or turning the lathe so as to bring the point of the tool in the other thread, provided the pitch of screw on work in the lathe is an even number of times greater than the pitch of lead screw, as 2, 4, 6, etc. times.

Or it may be accomplished by disconnecting immediately below the gear on stud, and turning the lathe, together with the stud, one-half a revolution, and placing the gears again in mesh.

It is well to chalk two teeth which bear against each other before disconnecting, and mark a tooth on the stud gear directly opposite the first mark, so that there may be no trouble in changing one-half revolution. Should the stud and spindle not revolve at the same speed, it is the spindle which must be turned one-half revolution, letting the stud revolve as far as it may.

In cutting a thread on a lathe which is without a reversing belt, and where the nut will not drop in the lead screw at every point, and correspond with the work, the following is a safe practice:

When the tool has run sufficiently far beyond the end of the thread for clearance, stop the lathe and make a chalk mark on shears of lathe, opposite a corner projection, or mark on carriage. Make another mark somewhat further back than the length of the screw on work. The distance between the marks must be the shortest distance, or multiple of the same, which will contain a whole number of threads on lead screw, and a whole number of threads on screw on work. Open the nut and move the carriage back to the latter mark; close the nut and go ahead, stopping lathe again at former mark and repeat.

Example: We have a four-thread lead screw lathe and no backing belt. We want to cut 11⅓ threads to fit two-inch gas pipe. In this case, after stopping the lathe, we move the carriage back three inches, which space will contain exactly twelve threads on lead screw and 34 threads on work in the lathe.

The coming spring bids fair to be a busy time among railroads. English rail manufacturers in the past month received orders from this country for not less than 70,000 tons of steel and 20,000 tons of iron rails.

It is proposed by a company to build water works in Kingston, N. Y., which is without that desirable improvement. A joint committee of Aldermen and citizens is considering the proposition.

Syracuse, N. Y., proposes to impose heavy bonds upon the new Holly Steam Heating Company, so that its streets and walks will be kept in good order after the pipes are laid. The company must have a capital stock of $150,000, all subscribed, before it can operate in the city.

A committee of workmen at the Bay View rolling mills, Milwaukee, have had a conference with the managers, and wages for the ensuing year have been adjusted on the basis of $47 per ton, an advance of 28 per cent. over the rates of last year.

Letters from Practical Men.

MACHINERY IN LUMBER MILLS.

Editor American Machinist:

I wish to call your attention in this epistle to the magnitude and importance of the lumber trade, and how largely machinery enters into the work of producing lumber. There is an omission in the list of occupations named upon your title page, and the word *millwrights* added there will supply that omission.

Let us stick a pin or clinch a rivet right here. I don't claim that this harbor town of Lake Michigan is the center and hub of the whole lake region, but I do claim that, as a manufacturing point for lumber—as one single place, standing upon its own merits, and doing its own work, unaided by tributary mills—it is not surpassed in the world in the efficiency of those mills, or in the amount of lumber produced. A visitor entering Lake Muskegon from the great lake (in this way a wide and satisfactory view is obtained) is surprised and impressed by the appearance of the place. He finds that this inland town—made "inland" only by a body of water, measuring from its mouth at the great lakes, six miles in length by two in breadth—is a steaming, smoking Pittsburgh in its way. But the steam vanishes cloudward hastily, and the smoke, unlike that of the great iron burgh, is made from sawdust or slabs and lingers not to offend the nostrils or stain the snowy linen of the housewives, pendent in their yards. In the range of this mill circle, for the line of travel winds around both extremities of Lake Muskegon, there are thirty-four mills, several of them capable of cutting, in day work alone, 30,000,000 feet of lumber. This is but the work of one mill, with two circulars and a gang of saws, in a period of a little over eight months, or for "the season." The log crop delivered by the Booming Company of this place to the several mills during last summer, foots up in feet 432,000,000. To do such enormous work, it must be seen that we must have strongly made high pressure engines, high speeds, good saws, and improved machinery in each department. Our log crop, like the hog crop in Chicago, is slaughtered in first-class shape. No engines used here are under 22″x30″, and we have cylinders up to 28″ diameter. The power employed in the lumber business here, in the shape of steam engines, may be put down at 8,000 H.P. The largest circular saws made by your Eastern makers, are revolved at 650 and 700 turns a minute. A gang of saws, say 40 uprights in a frame—has its crank shaft of ten or twelve inch stroke, with a weight of 2½ or 3 tons upon it, making 230 turns per minute. The pressure of steam carried averages 90 lbs. to the square inch. I have noticed, recently, in some lumber journals, "class" periodicals, extended reference made to the heavy cut of 1879, on the shores of Lake Muskegon. The writers made no allusion whatever to the foremost agency—next to the main engine itself—responsible for the increase of production. It was undeniably due to the almost universal adoption of the "steam feed" in the mills here. The steam-feed is really an auxiliary engine, not that it aids the prime mover; it does just the opposite thing, in that it imposes on the main engine additional strain by its rapid and unyielding feed against the saw—unyielding unless the operator chooses to let up on his feed. The "steam-feed" in the shape of a long cast-iron cylinder made in "pipe" sections, with accurately-faced flange joints, and bolted, lies upon the floor-beams under the circular carriage. Its piston-rod grips the first girt of the carriage, and there is your engine "auxiliary," so far as an advance in "dead sure" efficiency is concerned.

The sawyer's hand grasps his lever or starting bar slightly, for the valve is balanced, and thus frictionless moves as easily as you lift your watch-guard. There are stationary "bumpers" fastened at each end of the stroke line, provided in case of accident to arrest the carriage and save the cylinder heads, but the skilled operator will handle this crankless engine month after month, "cushioning" as he reverses, sending the carriage back like a shot. His carriage crew of "setters," standing with their limbs well braced, will clear the "bumper," often by a shave, but will not strike it. Some time, if you wish it, I will give you the history of the introduction of the "steam feed" here and in Wisconsin. It is instructive, to say the least.

Yours respectfully,

DAVID LANAGAN.

Muskegon, Mich.

TURNING BEVEL GEARS.

Editor American Machinist:

There are a number of machinists that never have had occasion to turn bevel gears, but a few rules will enable them to do it. If more than one gear is to be turned, the quickest way is to turn the diameter first on all of them, then turn the face angle. In turning the face angle care must be taken not to go below the diameter, but to leave enough to turn off the end angles.

The cut, I think, will make it plain. Referring to this; 1, is the diameter, 2, the face angle, and 3 the end angle. The end angle is not always given. To find it, add face and bottom angle together; and divide by two; take this result and subtract it from 90°. The difference will be the end angle. When the lathe has no compound slide, set a side tool to a bevel protractor; set the stock on the face plate and set the side tool to the slide arm. When turning, guide the tool down the same angle as that to which it is set. The gears should be roughed off first.

T. W. R. MCCABE.

Philadelphia, Pa.

LOST POWER.

Editor American Machinist:

DEAR SIR.—If you will kindly allow me, I would be pleased to make a few remarks upon the subject of "Lost Power," from the pen of Mr. Wm. H. Odell, in your issue of Jan. 31st, 1880.

In attempting to discuss the subject, I wish to disclaim any connection with the title of Ph. D., but hope that will not disqualify me from considering the subject in the few lines herewith presented.

What the fly-wheel has to do with the lost power is more than I can fathom, or that there is any lost power, in the exact sense, under the circumstances, is stranger still. Suppose, for instance, that the rim of the fly-wheel presented had happened to weigh double the quantity mentioned, there then would, according to Mr. O.'s reasoning, be a greater loss of power to be accounted for, and, consequently, more "abundant food for reflection."

What the indicator diagram presented has to do with the lost power in the fly-wheel I am again dull enough not to comprehend. That the area enclosed by the figure of the diagram pertains only to the amount of work done—which, less the friction of the engine, has finally been transmitted through the wheel in overcoming the resistance of the load—is patent and accepted. It shows, as it were, a balanced condition between the energy exerted by the steam and the load overcome.

That the office of a fly-wheel is any other than a regulator of motion, making uniform velocity approximately possible, is denied, without any reference to the excess of the mass of matter it may contain over and above the actual requirements.

It appears, upon steam being admitted to the piston of a steam engine, the fly-wheel commences its revolutions, slowly at first, being gradually impelled, and storing up energy at the expense of the entering steam, until it has acquired its full uniform velocity, or that determined by the adjustment of the engine "regulator." This lost power, if it may be so called, will reappear when the steam is shut off from the piston, and the wheel gradually comes to a state of rest.

The heavier the wheel, the longer will the engine be in attaining its uniform speed, and, when the supply of energy is discontinued, the longer will it be in coming to that state of rest, giving out, in its decreasing speed, a corresponding amount of work to that applied upon being set in motion in the first instance. This work is frictional or useful, as the case may be.

To sum up: the weight of a fly-wheel is an accidental quantity, and I fail to see its connection in the calculation under consideration. It is a receiver and faithful transmitter of what it has received to the last pound, upon call. Hence, if the wheel Mr. Odell has operated upon had happened to have "tipped the scales" at a few thousand pounds more, I scarcely think it possible that a satisfactory explanation would not have forced itself at once. As he hopes to return to the subject at some future time, I trust that I have only anticipated his more mature conviction upon farther investigation.

Yours respectfully,

A READER.

Feb. 1st., 1880.

CUTTING SCREW THREADS.

Editor American Machinist:

I am frequently interested in the ingenious formulas which appear in the mechanical papers from time to time, and especially those relating to the cutting of screw threads. Within the past year, I have seen not less than ten different rules for finding the proper gears, four or five of which were by your own correspondents.

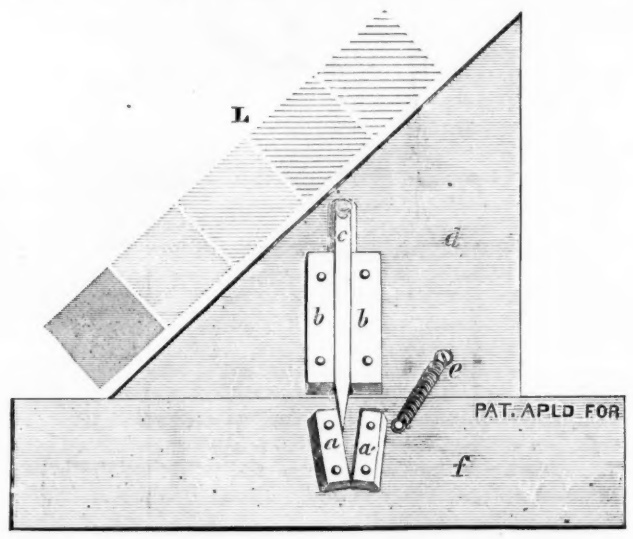
It is presumed that they each are correct, and, consequently, in all probability, one is equally as valuable as another, for the great diversity of minds renders a rule that will fit one man useless to another; but I do not remember to have seen the simple statement that *the proportion existing between the feed screw and the screw wanted, must exist between the driving and the driven gear.*

This fact once known, the machinist need not depend upon his memory of formulas in order to select the means which may be at his hand for cutting screw threads. Any formula for screw or gear cutting, calculating speeds, sizes of pulleys, leverages, lengths of belts, etc., or for solving any of the thousand-and-one problems that are continually coming before the mechanic, is only a rule for ignorantly ascertaining the relation of cause to effect, and *vice versa.*

The man who tries the hardest to remember formulas, is the one who knows the least about principles; and it has long seemed to the writer that a series of articles from the pen of a competent mechanical engineer, upon the relation and application of the laws of cause and effect to the principles and construction of machinery, would be worth more to the ambitious mechanic than the superficial knowledge of formulas. The art is fast approaching that stage when the mechanic is expected to know something with his head as well as with his hands, and that your invaluable paper is a most powerful agent in the accomplishment of so desirable a result is the reason why I have had the temerity to offer a single suggestion.

Bridgeport, Conn. J. E. WILSON.

Honey's Parallel Ruler.



HONEY'S PARALLEL RULER.

Many devices have been invented for the purpose of facilitating the slow process of section lining, or drawing straight lines parallel to each other.

The instrument shown in the illustration herewith was designed by F. R. Honey, instructor in geometrical drawing in the Sheffield Scientific School of Yale College, his object being to furnish a cheap and efficient instrument designed to be used in drawing section lines; but it may be applied to a great variety of work, as will be evident to any draughtsman. Its simplicity, and the nominal price at which it can be procured, place it within the reach of those who cannot afford to purchase the more elaborate instruments designed for the same purpose. The method of operating it will be understood by reference to the accompanying engraving. The part *d* is an ordinary triangle, or set square, having mounted upon it two parallel guides, *b* and *b*, between which slides a tongue *c*, tapered at one end. The part *f* is a *straight edge*, on which are mounted two guides *a* and *a'*, which are parallel respectively to the sides of the tapered end of tongue *c*, when the triangle and straight edge are applied to each other as shown in the engraving. The triangle *d*, and the straight edge *f*, are attached to each other by the spiral spring *e*, the effect of which is to keep the guide *a'*, in contact with the corresponding side of the tapered end of the tongue *c*. In order to draw a series of parallel lines, place the instrument in the position shown in the engraving, and rule a line along the longer edge of the triangle. Hold the straight edge *f*, firmly in its place and slide the triangle *d*, along it until the other side of the tapered edge of the tongue *c*, comes in contact with the corresponding guide *a*, and then allow the straight edge to be drawn by the spring, *e*; the guide *a'*, is thus brought in contact with the corresponding edge of the tongue *c*. Draw the second line, which will evidently be parallel to the first. The operation may be repeated, and any number of parallel lines drawn, and the distance between them will be regulated by moving the tongue *c*, as far as may be desired into the space between the guides *a* and *a'*.

For drawing very particular lines and close work, a straight edge, or the blade of the T square, may be placed in a suitable position against two pins placed in the drawing board, thus preventing the danger of irregular lines, caused by the possibility of the instrument slipping the least conceivable amount. The small square at *L*, shows specimens of parallel lines at various distances apart, which may be drawn by the aid of this instrument. It is manufactured by Paul Roessler, optician, 251 Chapel Street New Haven, Conn.

Cohnfeld's Automatic Steam Boiler Feeder.

The question of filling a steam boiler by means of a self-acting or automatic device has been duly considered, and has occupied the attention of many inventors. Its importance has been developed in the manufacture and use of steam boilers, and has necessarily resulted in the invention of a great many kinds of apparatus, all of which tend towards the same object; maintaining the same level in the boiler at all times. Hitherto these inventions have had but very little practical value, owing to their not being positive in their action, and consequently unreliable. The apparatus shown by the illustration on this page was invented by S. G. Cohnfeld, Zaukeroda, near Dresden, (Saxony) Germany. It was introduced into Germany several years since, and used with success. It is said to be reliable, and works with a degree of regularity which seems to have been appreciated from the fact that over five hundred boilers are supplied with water by this apparatus.

The apparatus is illustrated by the accompanying cuts, where Fig. 1 shows it as attached to a boiler, while Fig. 2 shows a sectional view through the center. It consists of a large vessel, which is divided into two separate parts A A', by means of a partition near the center. This partition is made a non-conductor of heat, by the insertion of wood in the center, which is imbedded in the cast iron, as shown. The suction pipe i, which opens into the upper vessel A, supplies the apparatus with water from the tank or reservoir, while the lower vessel A', discharges its contents into the boiler through the filling pipe S, Fig. 1. Both pipes are closed alternately by a suitable valve.

The two vessels A and A' are connected by the two pipes, F and e, Fig. 2, which are shaped like the letter U. They are connected as shown in Fig. 1. The stand-pipe p', enters the top of the boiler and terminates at the point intended for the mean water level. Upon the top of this pipe is placed the water cut-off valve d, which has an alarm whistle y', and still another y, upon the highest point of the pipe e. An air valve x is placed upon the large vessel A. The operation of this apparatus is as follows: When the mouth of the stand-pipe p', is closed by being immersed in the water in the boiler at V, the apparatus is at rest, and all its apartments and pipes are filled with water. But as the

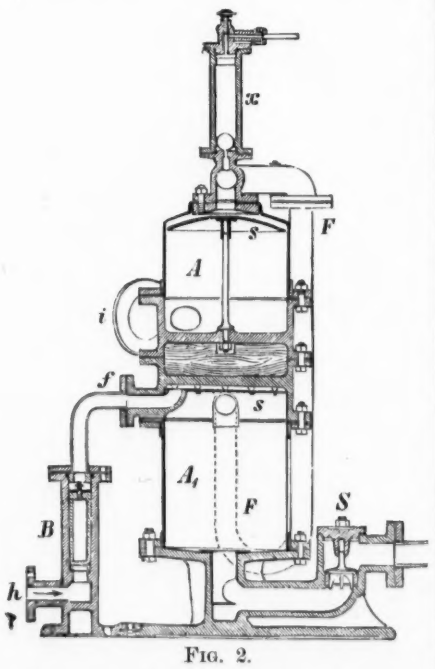


FIG. 2.

SECTIONAL VIEW OF BOILER FEEDER.

water level in the boiler falls, so as to free the mouth of the stand-pipe p', the steam will rush up the passages p d h B f (compare figures 1 and 2), the air being allowed to escape through the air valve x. The steam, passing into the lower vessel A', equalizes the pressure between the vessel A' and the boiler, and the water, run by its own gravity, passes into the boiler through the filling valve S, and following.

In a few seconds, the water in the vessel A', will sink to the level of the curve in the pipe F, when the steam will instantly rush into the upper vessel A, causing the water in this vessel to flow through the pipe e, into the lower vessel A', thereby repelling it. The steam in the vessel $A,'$ is condensed by the closing of the filling valve S, thus forming a vacuum in this vessel, which communicates itself to the upper vessel A, causing the water to be drawn or sucked from the tank or reservoir, until both vessels and the pipes are again filled. The apparatus remains at rest in this condition until the water level in boiler falls, when the same operation is again repeated, thus constantly

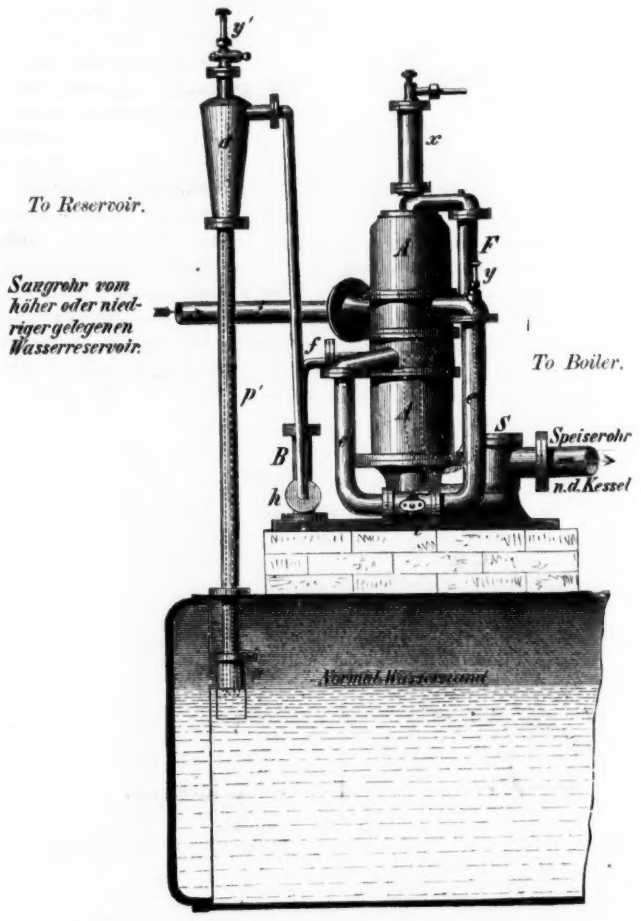


FIG. 1.—BOILER FEEDER ATTACHED TO BOILER.

maintaining the same water level in the boiler. Where a boiler is worked up to its full capacity, the action of this apparatus will necessarily be repeated more frequently. The acceleration column B, is placed in connection with the steam pipe, which prevents a constant flow of steam from the boiler into the apparatus, and may be described by referring to Fig. 3. It is composed of a shell or column b, inside of which is placed a valve a, filled with lead.

This valve has four guides or wings, which allow it to work freely up and down. It has projections at the bottom which allow the steam to pass the valve without interruption. During the filling operation, this valve remains in the position shown in the cut, thus allowing the steam to flow into the vessel $A,'$ but as soon as the pressure in this vessel becomes reduced, the excess of pressure under the valve a, will throw it up against the seat at the top, and holding it there prevent the entrance of the steam. A little slot c, prevents the valve from sticking to the seat through the formation of a vacuum in the vessel $A,'$ and allows the valve to fall by its own weight when the filling process is completed.

The alarm whistle y', upon the water-cut-off d, is placed upon a separate pipe which passes down the stand-pipe p', terminating a little below the mouth of it, as indicated by the dotted line, which represents the lowest allowable water level.

Should the apparatus fail to work from any cause, and the water in the boiler fall below the mouth of the pipe shown by the dotted line, the steam will pass up the pipe and blow the whistle. While the pipe is filled with water this whistle will not sound. A cock is provided by which the communication between the whistle and boiler may be closed, as shown. The other alarm whistle y, is so arranged that should the water become exhausted in the reservoir, or from any cause fail to reach the apparatus, the steam entering the pipe e, as at the commencement of the operation of filling the boiler, and not meeting the water, will heat up the pipe and melt a thin composition or soft metal plate which allows the steam to enter the whistle, thus giving an alarm to the engineer.

The inventor claims that, by the application of this apparatus to a steam boiler, the boiler is filled during the night as often as may be required, and by this precaution many of the explosions caused by firing up boilers containing insufficient water may be almost, if not entirely, avoided.

Leather Gear Wheels.

A genius in Mezingen, Wurtemburg, has devised a process for making toothed wheels of leather instead of metal. The advantages claimed for them are that they have a much quieter and more elastic run, are extremely durable, and require no lubrication whatever. They are prepared from raw, untanned buffalo hides, thoroughly cleansed from all hair, flesh, etc., and glued together in as many layers as are necessary to produce the breadth of wheel required. The cementing is effected under very heavy pressure, as in an hydraulic press, and this is kept up until the glue has completely hardened. From the sheets, or plates, thus prepared, the teeth are cut out by saw and chisel.

Personal Qualities of Shop Foremen.

A late issue of the *National Car Builder* contains an excellent article on the economical management of railway mechanical departments, from which we extract the following. It is applicable to the foreman of any machine shop:

Shop foremen should be selected with care and discrimination. Their executive capacity, personal habits, knowledge of men, etc., should be well considered. If they are promoted from the ranks, it should be ascertained whether they have been wasteful or economical in their work, or prone to idle away time as often as opportunity offered. Their peculiarities in these respects, whatever they may be, are sure to be known to the men who come under their direction, and they will be influenced accordingly. Those who are naturally disposed to idle and shirk, or play "soldier," as it is termed in shop parlance, will do so if the foreman is known to be of that class. If pushed, they will get angry; and an angry man is worse than no man at all, for he is apt to be malicious. If a foreman is morose and snappish; if he has an idea that discipline depends upon the number of oaths he can utter, and the petty slurs he can cast on the men under his charge, the company will be out of pocket several times the amount of his wages annually, and for reasons that are too obvious to need specification. A foreman who has a repulsive manner prevents workmen from making necessary inquiries, and places them in an unpleasant position. He often fails to give clear and definite orders, and blames workmen for inferring or not inferring something aside from such orders. The result is, that in such cases men become more or less demoralized and indifferent, and do what any man *can* do in a repair shop, if he is so disposed—steal from ten cents to a dollar's worth of time every day, besides wasting material which might just as well be saved.

As an illustration of what has been said above, the writer noticed in a shop the other day, a young man busily engaged at his work, and with a seeming interest in it; but as he worked, he whistled. The foreman came along, and remarked, by way of rebuke, "Less noise, and more work." The noise stopped, and so did the work, to an extent perhaps that taxed the company a dollar or so for the day.

Utilization of Waste Material.

BY THOMAS F. HAGERTY, M. E.

The extent to which the packing of fruits, vegetables, and other edibles has been extended within the past twenty years has called for an immense consumption of sheet tin, which is the only material that meets all the requirements of the trade. There must necessarily be a great waste in the old used-up cans, as so far but little effort has been made to utilize them for manufacturing or other purposes.

In small cities and towns they have become a nuisance, as the only use to which they have been applied is to afford amusement for the village urchin, who places them on fence posts and pelts them with stones, kicks them with his "metallic-tipped toes," or, bores a small hole in their bottom through which he attaches a waxed cord, converting them into that inharmonious harp of a single string—"the squeedunk."

There are many useful purposes to which the old tin packing-can might be applied, but, I believe, the following will be found the most profitable. Collect all the cans you may require, say 100 quart cans; prepare a bright fire in the kitchen stove, and have the cans close at hand. Have a cloth in each hand; place a can on the stove lid, and when the solder which holds the top or bottom to the body begins to melt, place a can on the other lid and remove the first one, and with an old knife, old file, stove-lifter, or anything at hand, knock off whichever end you

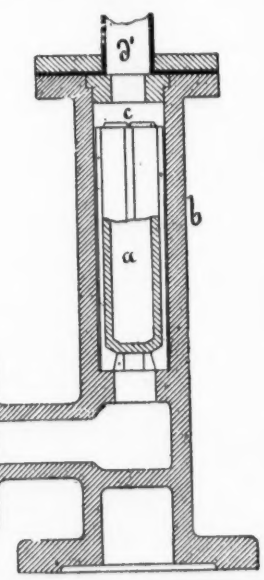


FIG. 3.—ACCELERATION COLUMN.

may have placed next the fire. In most cases it will drop off. With the cloth in the left hand hold the can, and with the right hand wipe the melted solder, from the inside and outside of the edge quickly, before it sets. Remove the next can and replace it with another, and repeat the operation until both ends of the 100 cans are freed from their tops and bottoms. You now have 100 tubes, 4¾ inches long by 4 inches diameter.

These 100 tubes can, with but little skill,

be converted into 35 feet 5 inches of 4-inch *drain pipe*, which, to a farmer or house owner would be *worth more than the original cost of* 100 *cans filled with tomatoes*. In order to prepare them so that the end of one tube will enter ¼th of an inch inside of the other, take a tube in the left hand, place one edge over the corner of a pine table, if nothing more convenient is at hand, and with a mallet, hammer, or a piece of stick, hammer the edge downwards, turning the tube regularly every stroke. Place the other edge of the tube on the edge of the table and strike it from the inside, turning regularly. By this operation one end will be crimped, and the other enlarged. It requires but little enlargement to make one end enter and admit of being driven tightly into the other.

They should be put together in lengths of 6 tubes. The seams should not come on a line with each other. To insure strength the joints might be tacked with a soldering iron, but if they are forced tightly together they will be water tight. A coat of common paint, or tar, inside and outside, would make this pipe last for years underground, and if properly packed in the earth it will have ample strength to resist external pressure. Enough fine solder can be saved from what is wiped off the joints to mend all the household tinware for a lifetime.

Science and Stumbling Blocks.

BY PARK BENJAMIN, PH. D.

The publisher of a well-known periodical informed me, the other day, that he has been for some time past trying to get up an article composed of brief descriptions of some new labor-saving devices. His object—which it is not necessary here to detail—was a very commendable one, and he proposed to obtain his information from manufacturers themselves, expressly assuring them, at the same time, that the publication would not cost them a penny. To this end, he got up a nicely-worded circular, which he disseminated freely, and then waited for replies. The latter numbered exactly zero, not a single manufacturer noticing the request.

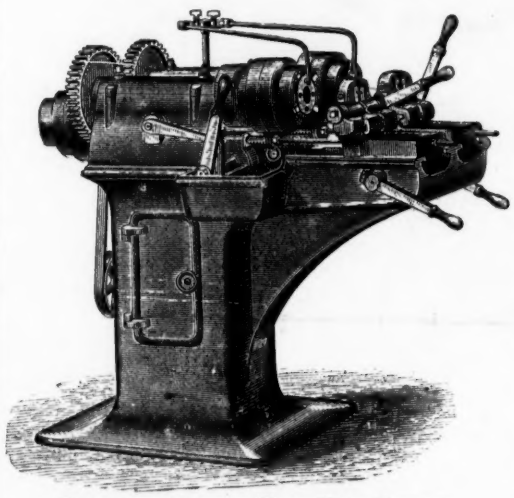
This circumstance corroborates some experience of my own, which hitherto I have believed phenomenal. Charged with the laborious and difficult task of editing a large standard mechanical work, and not desiring to follow the usual course of rehashing old matter out of books, I prepared some circulars which it seemed to me could not possibly be mistaken for advertising bids. I printed "Request for Information," in big letters across the top. I explained minutely the nature of the work, its necessarily impartial character, the fact that nothing however remotely resembling an advertisement would be allowed in it on any terms, that its opinions could not be bought, that no claim for pay direct or indirect would ever be made, and so on through a string of assurances, rather damaging to a sensitive self-respect, but unfortunately too obviously necessary.

It is safe to say that in the majority of cases no reply at all was vouchsafed. The answers received were divisible: 1st, into assertions that "We don't want to advertise;" 2d. "Will be happy to fill your orders at 15 per cent. discount for cash." 3d. "We enclose our price list and descriptive (?) circular;" and, 4th, intelligible explanations or responses to questions; these last very, very few, and exceedingly far between. Personal letters, addressed to special firms were more successful, but in all correspondence received the writers seemed oppressed by a gnawing horror that somebody some time was going to pounce on them and make them pay something. One individual, who loaned me one very small, and much-battered electrotype, wanted his mind soothed by a written undertaking that he should be protected against the onslaught of the wild advertising man; another timorous person wanted a formal conference between his concern and the publishers of the work, to find out whether I was authorized to borrow a minute and smirchy cut of a third-rate machine, or to admit him to a proposed series of tests, laid before all makers of like apparatus. I could give scores of such instances; but it is not necessary to multiply them, though it is, perhaps, curious to remark that—now that the work is published, the concerns who are loudest in their complaints of not having proper attention paid to their products, were those most persistently addressed without eliciting any reply. One firm, which appears to be in agonies of grief because a competing machine, and a better one than theirs, has been given a prominent place, were communicated with no less than *nine* times, yet they assert that they were overlooked and slighted.

The object of this writing, however, is not to air the results of a rather disagreeable experience, but to direct attention to the peculiarity on the part of manufacturing concerns here indicated. Intelligent manufacturers have, over and over again, in my hearing, regretted the paucity of really practical mechanical works. How, I ask, are such books, or even articles, to be made without the co-operation of the manufacturers themselves? If an author could visit personally the various shops, doubtless he would meet with civil and courteous treatment, and, after he had banged into the heads of the managers of the concerns that he was not an advertising canvasser, he might be told much that would be useful to him. But in a country so vast as this, it is scarcely possible to spare the time and money to make long journeys from place to place. Any other means of communication summarily fails. Nor can I discover the remotest reason for the strange suspicion which is the cause, not merely of the failure, but which drives in disgust honest, and capable engineers and mechanics out of the field of scientific literature. Are our manufacturers in the habit of being blackmailed? Are they so afraid of any person connected with any publication, standard or ephemeral, that they assume, as a matter of course, that he will get the better of them if he can, and that it behooves them to be wide-awake to head him off? In an experience of ten years' direct connection with the mechanical and scientific press of this country, I have never known an instance savoring of compulsion or sharp practice; and I venture to affirm in the most positive manner that there is no class of journals extant more fair, well-meaning, and straightforward than those which labor in the field of science and applied mechanics. That this is not true of some other classes of newspapers is only too well known. The charges against insurance periodicals have been frequent and serious, and abundant instances have occurred where the term "trade journal" has been synonymous with a paper existing upon the fears and inter-necine jealousies of the trade it misrepresents.

It is true that scientific journals are getting to be rather numerous, and that they all seek the same source of support. It is equally true that their appeals are pathetically urgent in the inverse ratio to their circulation; and hence, the manufacturer generally finds those least likely to be of any use to him most prominently thrust upon his attention. But the "survival of the fittest" is an immutable law in journalism, as in all animate nature. There is no way of getting less for more money than by running a newspaper; and a drop in a fancy speculative stock on a "bear" market, or the downward dash of an aerolite is slow, compared with the sudden obliteration of a specialty journal when its funds give out. Of course, a manufacturer who advertises in such a paper gets no benefit for his outlay, but that is his own fault. He gets his advertisement cheap—sometimes very cheap—frightfully cheap. I know a "practical" scientific paper, started within the last few weeks, which is magnanimously publishing four pages of advertisements—all it has—gratis. Nobody can say that such a paper is not "acting square" by its advertisers.

The moral of this rather rambling discourse is, I hope, sufficiently evident. There is an effort, and a strong one being made, to provide this country with an adequate mechanical literature, the object being to reduce American mechanical practice from empiricism, toward which it is apt to tend—in fact, is tending—to definite, well founded knowledge. Some 17,000 patents a year are granted to American inventors. An immense number are rejected; and out of those obtained a large proportion prove useless, and are unworked, while others form the subject of prolonged and expensive litigation. The more widely definite, practical knowledge of science and mechanics can be disseminated, the less likely will the inventor be to wander into useless paths, and the greater the saving of time and money to the community. The better and more accessible, sound, practical information is made, the cheaper and better does education come to the workman; and in proportion to the growth of his intelligence, are the excellence and superiority of his handiwork. However fiercely and bitterly our manufacturers may compete among themselves, they cannot shake off the common bond of country, or avoid the fact that they are a unit with a single interest in competition with the labor of foreign nations. It is said too commonly now, that while the United States will remain the great food-producing country of the world, England will always retain her supremacy in manufactures. Over this last question the struggle is to come; and returning prosperity brings it daily nearer to us. As literature, in general, links together whole races of people of similar language, so a literature of specific character unites and strengthens the class to which it belongs. To block the progress of such a means of advancement and of strength, by negligence or unfounded suspicion, reacts on the whole community, and most potently on those who obstruct the way when they should make it clear.



NATIONAL DOUBLE HEAD BOLT CUTTER.

National Double Head Bolt Cutter.

The peculiarity of the National Bolt Cutter (one style of which is shown upon this page) is the instant release of the bolt when threaded without running back through the dies. The die head is constructed to receive finished blocks or cases with inserted chasers forming the dies, thus doing away with the labor of fitting each die or chaser to the head. The chasers, four in number, in simpler form, are planed or fitted to cases with a file, from pieces of flat steel averaging 1½ inches in length, and $\frac{5}{16}$ inches in thickness, threaded in the machine by hobs or master taps, and set forward by a screw in the end of each case for dressing when the thread is worn out. In the finished form the chasers are made upon the interchangeable system, with threads at each end, are held in the cases by studs, and are as serviceable as two sets of dies. Broken or damaged chasers can be replaced by duplicates at little expense. The adjustment of dies to the proper diameter is accomplished by merely turning a screw in the front of the head. The die head can be quickly stripped without removing it from the machine. One set of case dies can be removed and another inserted in the head in less than one minute by changing a stop pin, projecting from the sleeve, from its position when the machine is working, to a point opposite a hole in the flange at the rear of the head; then, by means of the lever, pushing the sleeve back to the flange, uncovering the cases, and permitting their removal and replacement by hand. The machine can be quickly converted into a nut tapper, by removing the case dies and putting in their place a steel block to which is secured a universal chuck for holding taps that is furnished with each machine. All the working parts of the die head are protected from chips or dirt. The hollow spindle allows a piece to be threaded any distance desired. The machines work rapidly, the bolt being cut to a full thread at one operation. The one shown in the engraving has a double head and is made of three different sizes, one cutting nine sizes of bolts and the other two, seven sizes. They are made by The Pratt & Whitney Co., Hartford, Conn.

(*Reprinted from the American Machinist, Dec.* 1877.)

Sizes of Safety Valves.

BY PROF. R. H. THURSTON, OF THE STEVENS INSTITUTE OF TECHNOLOGY.

The office of a safety valve, as used on a steam boiler, is to discharge steam so rapidly, when the pressure within the boiler reaches a fixed limit, that no important increase of pressure can then occur, however rapidly steam may be made. It has also another office: it should be so constructed and arranged that, should any accident occur, it may be opened by hand and the steam pressure lowered very rapidly, even when the fires in the boiler are burning brightly and generating steam with maximum rapidity. The size of a safety valve is determined by the character of the valve itself, by the pressure at which the steam is to be discharged, by the difference permissible between the pressure at which the valve is to open automatically, and that at which it is intended to be capable of discharging steam as fast as the boiler can make it.

A valve of defective design or badly constructed must necessarily be larger, to do the same work, than one of similar type badly designed and constructed. Steam is discharged at any given rate through an orifice of smaller dimensions as the pressure increases; the lower the pressure, on the other hand, the larger must be the valve. A boiler in which steam is carried at 20 pounds by gauge may require a safety valve of 30 inches area, while the same quantity of steam would escape through a rivet hole in a boiler containing steam at pressures such as were attained by Perkins and Albans a generation ago.

Rules by which to calculate the proper area of safety valves for every case arising in his practice, are used by every engineer accustomed to designing steam boilers. These rules vary considerably with differences in the experience or the judgment of their authors. The builder is often inclined to adopt valves of too small size because of the expense of putting on large valves. The engineer, who has once nearly met with a serious accident, to obtain ample security against a repetition of the experience, at once adopts valves of excessive areas; and the designing engineer sometimes bases his rule on improper assumptions, or is ignorant of the true conditions, or of the proper method of stating them in the form of a rule. Attention has been lately called to these discrepancies, between the rules given by various so-called authorities, by a writer in a well-known periodical; but the writer, unfortunately, concludes by commending the rule of Prof. Rankine, which, for general applications, is about the most defective of all. It is correct for certain pressures and under the conditions which existed in the experiments and observations on which it is based. Containing no reference to the pressure of steam, however, it simply misleads when generally applied. The conclusion is, not that Rankine was careless in framing the rule, but that the engineer, in applying it, must understand under what circumstances it is applicable. The same remarks apply in some degrees to the rules attributed to the

writer. The discrepancies noted in the report of the committee would have been less marked had the rules been properly used.

A rule for general application must always give an area determined by the quantity of steam to be discharged and the pressure at which it is to be discharged. A perfectly exact rule would involve the determination of other quantities, as the specific volume of the steam, the proportion of water carried by it in suspension, the difference between internal and external pressure, for the purposes of the engineers. These quantities may be neglected, or may be taken into account by a simple modification of the formula used, as will be presently shown.

Rules are very commonly used which are based upon the amount of coal burned per hour in the given case. Such rules involve the assumption that each pound of coal evaporates a definite and known quantity of water. Another class of rules make the area of the valve depend upon the dimensions of the boiler, as on the area of heating or of grate surface. These rules involve an assumption that the area of heating or of grate surface is proportional to the quantity of steam made in the boiler in a given time. It is evident that, with a given boiler, the conditions upon which rules of the first class are based are variable, while those of the second are constant. Rules based upon the weight of steam made, or of coal burned, in the boiler must therefore be determined by the *maximum* consumption of coal or production of steam for which the boiler is proportioned. Rules based upon the size of the boiler, or area of its grate surface, must be so constructed that the area given by them will be ample for the discharge of more steam than the boiler can make by evaporation from the given amount of heating surface, or by the combustion of all the coal that can be burned upon the grate under the conditions of draught which are to be anticipated. With a properly constructed valve, properly used, it is a matter of perfect indifference which kind of rule is adopted. The two classes of rules will give the same results if both are intelligently framed and applied.

The weight of steam in pounds which will escape through an orifice in the boiler having an area of one square inch is, in ordinary practice, very nearly fifty times the pressure of the steam measured from the absolute zero of pressure—*i. e.*, above a vacuum. The area of opening, therefore, for any boiler must be, in square inches, the weight of water evaporated per hour as a maximum, divided by fifty times the gauge pressure, with fifteen pounds added—*i. e.*,

$$a.=\frac{w.}{50.(p.+15).}$$

or, $$a=0.02[w+(p+15)].$$

But a safety valve, as has been stated, should be capable of discharging very much more than the maximum quantity of steam that the boiler can make when doing its best. The valve must be raised, ordinarily, by the action of the steam itself, and the force exerted by the steam pressure upon its disk rapidly diminishes as it rises from its seat. The seat is beveled, too, in such a manner that the effective area for discharge of steam is but a fraction of that due the rise of a valve having an unbeveled seat. It is, therefore, advisable to give a large excess of area over that above determined. How great this excess shall be is very generally determined by the judgment of the engineer, as formed by observation and experience and checked by direct experiment. Very few engineers, probably, err seriously on the side of excess.

In making up a set of rules for safety valve areas, some years ago, the writer adopted the rule: multiply the maximum weight of steam which the boiler is expected to generate per hour by five and divide by ten times the gauge pressure increased by ten; or, divide that weight by twice the latter quantity.

$$A=\frac{0.5\,w.}{p+10.}=\tfrac{1}{2}.\frac{w.}{p+10.}$$

The gauge pressure is increased by ten rather than by fifteen, in order to secure some additional excess at the lower pressures, a proportionally smaller difference between opening and maximum pressures being there admissible.

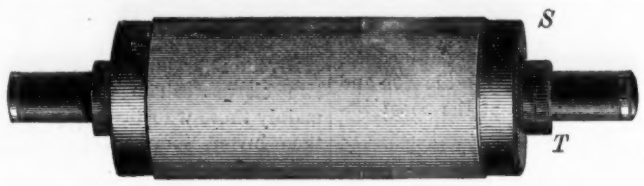


FIG. 1.—PAPER ROLL.

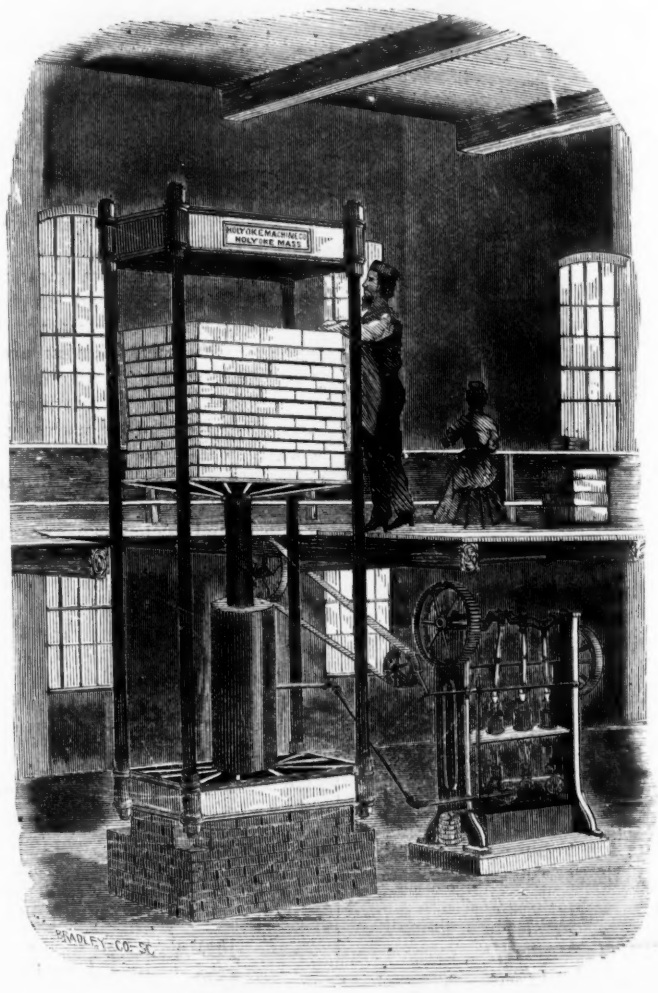


FIG. 2.—PUMP AND PRESS.

From this rule it is easy to deduce special rules for any other desired application, as to boilers of which the dimensions are given. Thus, the writer had occasion to design safety valves for steam boilers having a ratio of grate to heating surface of about one to twenty-five. These boilers had a "natural draught," and were expected to burn, as a maximum, about fifteen pounds of coal per square foot of grate. Such boilers will make, as a maximum, about 5 pounds of steam per hour per square foot of heating surface. A simple calculation based on these data would give the following set of formulas, in which w = the maximum weight of steam made per hour, h = the area of heating surface, g = that of the grate surface, and c = the maximum total amount of coal burned per hour.

$$A=\frac{0.5\,w.}{p+10}\ldots\ldots\ldots(1.)$$

$$=\frac{2.5\,h}{p+10}\ldots\ldots\ldots(2.)$$

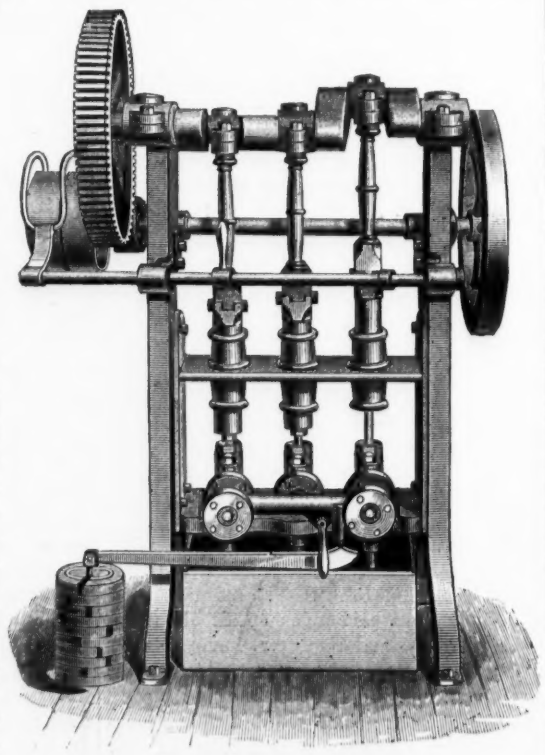
$$=\frac{62.5\,g}{p+10}\ldots\ldots\ldots(3.)$$

$$=\frac{4\,c}{p+10}\ldots\ldots\ldots(4.)$$

For boilers having different proportions, as locomotive boilers, with their tremendous forced draughts, or some stationary and marine boilers, with their vastly greater proportion of heating to grate surface or to steam made per hour, special rules must be constructed if the designer wishes to base his calculations upon their dimensions. As has been shown above, it is very easy to make such rules, the first of the set having been determined upon. No intelligent engineer will attempt to apply rules like Nos. 1, 2, 3 or 4 to exceptional cases, or, indeed, to use them at all without knowing upon what authority and upon what kind of practice they are based.

Rules in which the steam pressure is not taken into account are only applicable to some one pressure. The same caution is to be observed in using them. It is further evident that rules and formulas are not to be compared, except where they are adapted to the same set of conditions as in the example just given.

Very large boilers require such great area of opening for their safety valves that it is necessary to divide it between two valves; in fact, it is always much better to have two valves, even on small boilers. If an accident happens to one, the other is then to be relied upon, usually, to discharge the steam. The forms of safety valves are almost numberless. A description of some of the best is to be found in the report of the committee on tests of safety valves, appointed from the U. S. Board of Supervising Inspectors of Steam Vessels, in 1875. Among the very best is the ordinary "Lever Safety Valve," of Papin, as modified by the introduction of knife-edged bearing pins by that committee. The "Pop" Safety Valve is an excellent type for locomotives when given sufficient size.



THREE-PLUNGER PUMP.

How Paper and Cotton Rolls are Made.

In the improved web super-calendering paper machine, there are usually four chilled cast iron rolls, and three paper rolls. The manner in which the paper rolls are made by the Holyoke Machine Company, of Holyoke, Mass., who also manufacture the presses, pumps, and other appliances, incident to this branch of business, is herewith described:

The engraving, Fig. 1, shows a paper roll ready for use. The shaft passing through the center is made of the best iron. It is 6," or less, in diameter, according to the size of the calender required, and is turned up, having a journal turned upon each end. A short distance from the shoulder of each journal, a square groove is turned, to admit a steel collar, such as that shown at *T*. The groove is sufficiently far from the shoulder to allow a second ring (also shown) to be shrunk on the shaft. The first collar, which is intended to fit in the groove, is turned up, and cut in two pieces. The pieces are placed in the groove, and a larger collar shrunk upon the outside, thereby making a perfectly secure piece of work. The collar *S*, is then put in place, and the shaft placed on end in a socket under a hydraulic press, in principle similar to the one shown in Fig. 2.

The paper of which the roll is to be made, is manufactured from the best linen, and is about one-thousandth of an inch in thickness. It is cut to the proper circle outside, allowance being made for finishing, and has a hole cut in the center, to just admit the shaft. A suitable amount of paper is placed upon the shaft, and a pressure of eight hundred tons put upon it, and allowed to settle for a number of hours, when the pressure is removed. More paper is then added, and the operation repeated, until the requisite amount of paper is placed upon the shaft. It must be so adjusted that when the top collar *S* is put in place, and the final pressure applied the top of the collar *S*, will come exactly flush with the edge of the groove in the shaft. The small collar is then put into the groove, and the solid collars are then shrunk upon the outside, and the pressure is removed.

The pressure is applied to the top collar *S*, by means of a casting, which has an opening in the side large enough to allow the collars to be inserted, while the pressure is applied.

It takes three days to make a paper roll in the manner described. In one case, when the roll was finished, and the pressure being relieved, a shaft 6" in diameter, was pulled in two, owing to the expansion of the paper. After the roll is finished in the press, it must be turned on the outside, by a black diamond set in a holder, as steel will not do.

For some calendering machines, cotton is used in the place of paper, for making rolls. The cotton used is simply batting, which is put on in layers, and the pressure required is two thousand tons. The time required to make a cotton roll, is one week. When the roll is finished and struck with a hammer, it appears as solid as iron.

The Holyoke Machine Co. have two presses of 800 tons capacity each, and one of 2000 tons. The upright bars are of solid iron, forged to size, with solid forged collars. On the two thousand ton press these bars are 8" in diameter. The cylinder, or jacket for the press piston, is made of gun metal, with steel hoops on the outside. The diameter of piston is 20," and the total weight of the press is 35 tons. The new composition jacket for press pistons, which answers every purpose of solid brass pistons, and at much less cost is taking the place of the iron pistons of old presses, as fast as they are worn out. The press shown in Fig. 2 is designed for pressing writing paper, and is necessarily of lighter proportions than those described.

A new three-plunger press pump, shown in Fig. 3, is used for supplying power for hydraulic presses. This pump was designed with a view of making a more easily managed, durable and efficient working pump than has heretofore been furnished. In this pump, the valves are arranged to work quickly, are easy of access, without disturbing any other part of the pump, and the safety-valve is so hung as to obviate the common danger of getting jammed in its seat; thus causing a breakage of the pump or other parts.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.
LYCURGUS B. MOORE, Treas.
JACKSON BAILEY, Vice-Prest.
DAVIS STRONG, Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

The American News Company.
Publishers' Agents, New York.

The International News Company,
(Formerly the Willmer & Rogers News Co.)
11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.
Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

DEALERS SUPPLIED BY

The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis Book and News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh Book and News Co., Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Co., Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, L. I.
The Newark News Company, Newark, N J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.00 to Foreign Countries, postage prepaid.

ADVERTISING.

Outside page, 45c. per line, each insertion.
Inside pages, 25c. per line, (12 lines one inch.)
Business Specials, 40c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers who fail to receive their paper promptly will please notify us at once.*

☞ Entered at the Post Office at New York, N. Y., as second class mail matter.

NEW YORK, FEBRUARY 21, 1880.

CONTENTS.

	PAGE.
Practical Blacksmithing—Forges and Tuyeres for Light Work. Frederick Lewis	1
A New Planing Machine	2
Boilers for Machine Use. H. L. Stellwagen, M. E.	2
Locomotives for Canal Boats	3
Preserving Wood with Lime	3
Cutting Screw Threads in a Lathe. J. E. McConnell	3
Letters from Practical Men	4
Honey's Parallel Ruler	4
Cohnfeld's Automatic Steam Boiler Feeder	5
Leather Gear Wheels	5
Personal Qualities of Shop Foremen	5
Utilization of Waste Material. Thomas F. Hagerty, M. E.	5
Science and Stumbling Blocks. Park Benjamin, Ph. D	6
National Double Head, Bolt Cutter	6
Sizes of Safety Valves. Prof. R. H. Thurston	6
How Paper and Cotton Rolls are Made	7
Enlarging Machine Shops	8
A Promising Field for Invention	8
Balancing Things Evenly	8
Failures in Mechanical Inventions	8
The Millers International Exhibition	9
Notes of the Press	9
Literary Notes	9
Questions and Answers	9
Manufactures	9
Machinists' and Engineers' Supplies	10
Iron Review	10
Metal Review	10

Enlarging Machine Shops.

Since the quickening of general business began last summer, especially in the iron and machinery industries, one of the most important questions, affecting the success of both manufacturing and jobbing shops, is Shall we enlarge? To those who have never been confronted with the necessity of promptly acting upon this question, it seems very common-place, apparently involving nothing more than the present condition of the concern's business and its ability to extend its production by paying for more room and more machinery. To those who have thoughtfully watched the ups and downs of trade and the fortunes of their neighbors in like business with themselves, it is a problem of the deepest kind. If trade were not subject to such unexpected fluctuations, enlargements might be undertaken with greater confidence. Many establishments built large additions in the busy times of 1871 and 1872, which, at that time, seemed necessary and desirable, but many of them proved excessively burdensome, as soon as general activity was changed to dullness. Not a few machinery establishments have gone to the wall within five years as the result of too extensive enlargements, based upon an increasing accumulation of orders. It is not rare, at the present time, for a shop to be crowded with orders beyond its existing capacity to fill, even while working over time with all the help that can be employed. Quite a number are building additions and putting in new machinery to take advantage of this rush of profitable business, while others adopt the conservative policy of taking care of all orders that can be filled without extra outlays for buildings and fixtures. It does not follow that the latter are not progressive. They may have foresight keen enough to avoid the disasters likely to be encountered by their over-sanguine contemporaries.

When business is slack, small shops have a decided advantage over large ones. The expenses of rent (or interest on cost of shop), the loss by letting machinery remain idle and the wages of permanent foremen and skilled workmen, who cannot safely be discharged, greatly swell the cost of all work done in a large shop when running to only a fraction of its capacity. The proprietor of a small shop on the other hand can stop entirely for weeks at a time without serious loss. He is therefore not obliged to make excessively low bids for contracts when competition is sharp, though the man who has a large shop, to manage may lose more by letting his machinery stand idle than by taking orders at something less than the cost of filling them. But when business is lively the advantage is with the heavy concern. To complete contracts, small shops must be run at night involving many extra expenses This greatly reduces the margin of profits. A heavy rush of business usually lasts but a few months, while close competition generally continues for a period of several years. In considering an enlargement this fact should be not be lost to sight. Even the best and most favorably known establishments experience a falling off in the demand for their products in seasons of declining prices. Still, the anticipation is likely to be indulged in, that a steadily increasing trade may be enjoyed, without interruption, when an enlargement is decided upon.

The expansion due to the natural growth of a business should be distinguished from the increase of trade coming in a season of unusual activity. The ardor with which a concern starts out to distance all its competitors is not shared by the public at large.

The capacity of a shop often can be considerably increased by judicious improvements of processes and more skillful manipulation of machinery.

Some of our exchanges speak about an emery wheel manufacturer having lately "invented" a corundum wheel. It is possible that some new method of making a solid wheel has been discovered, but the "invention" of a corundum wheel is rather old. They have been in use for many years.

A Promising Field for Invention.

Inventors, as a rule, may be divided into two classes. The first division includes mainly those who first discover a want, and then invent some mechanical or scientific means of satisfying it. In the second is included that vast army of inventors who begin by inventing the appliances, and end by spending half their days and all their dollars in trying to adapt it to some use.

In a recent issue of an English exchange, we find the hint or suggestion of an invention, which should have a decided run in this country, and we do not doubt that, the necessity being known, our inventors will rally in a body to the speedy solution of the problem. Not to affect mystery, the desired appliance is a "Patent Fastener," intended to "properly secure machinery to the estate of the individual or firm to whom it ostensibly belongs." The need of some suitable contrivance for this purpose in this country, is so obvious as to require little argument.

As an illustration patent to all, the case of the Centennial Corliss Engine may be briefly cited. Immediately after the close of the exhibition, this engine was promptly taken to pieces and stored in the works of its maker at Providence. But, notwithstanding this action, every newspaper reader was informed that this famous engine, not content with straying off to Pittsburgh, had finally installed itself at the branch mint in San Francisco, where it was industriously engaged in coining gold and silver dollars. It is needless to add, that all the constabulary, and other expenses incurred in reclaiming this erratic machine might have been saved, had some suitable appliance for fastening it securely to the estate of its owner been employed or known.

No reader of the newspapers has failed to observe that vicious steam boilers, in all parts of the country, are daily pulling themselves loose from their fastenings, and exploding into infinitesimal fragments, upon little or no provocation. Nearly every variety of steam boiler known, has been occasionally addicted to this objectionable practice, notwithstanding the use of improved devices in many cases, and the employment of engineers at the munificent salary of $1.50 per day. The heavy pecuniary and other losses, that are continually arising from this cause alone, should prompt a large and growing demand for the apparatus under discussion.

Nor should it be forgotten, in view of the disastrous results continually occurring from the use of certain varieties of second-hand machinery, that a public sentiment might easily be created, which would make obligatory the use of an improved means of preventing this class of machinery from ever leaving the estate of its original user. A suggestion that steam boilers of this class, for example, instead of being puttied and painted into the semblance of safety, should be securely fastened to the *persons*, even of their junk shop venders, might not altogether lack support. Were such a law passed, it is clear that a very large market would be immediately opened up to some fortunate inventor.

Another very important consideration is the necessity of preventing costly machinery of all kinds from getting discouraged, and making way for improved mechanism. As a case in point, gas-making machinery just at this time would appear to be a fruitful field for the suggested invention. Since the present agitation upon the subject of the electric light was so unjustifiably begun by Mr. Edison and Mr. Brush, nearly all the gas-making machinery in this country has shown signs of disturbance, and there are grave fears in the minds of many persons, that the day is not far distant when all these costly appliances will pick themselves up bodily and go out of use. Clearly, there are grounds for presuming that some of the extortionate profits, heretofore realized by the gas companies, could readily be diverted to the pockets of the inventor who discovers some sure means of securing gas-making machinery to the estate of its owner. Doubtless, a little reflection will suffice to bring to mind many other directions in which such an improved device, as has been suggested in the foregoing, could reasonably be expected to find a market, but we forbear further comment.

The steady growth of the AMERICAM MACHINIST (which has now reached a regular weekly circulation of 10,000 copies) has been such, that enlarged facilities have become essential to its proper handling. The size of our edition, and the fine printing required, which is that known to the craft as book-work (necessitating a slow speed), have compelled our printer, Mr. James W. Pratt, 75 Fulton St., N. Y., to purchase an additional large press for the special accommodation of this paper. Under this arrangement, both presses are required to work together, eaeh printing one side of the paper. Mr. Pratt's reputation as a skillful printer is a guarantee that the neat typographical appearance of our columns will continue to be a distinguishing feature.

Balancing Things Evenly.

In the steam and mechanical engineering of our day, the tendency is too often towards laying an undue stress upon certain parts, to the disadvantage of the whole. No machinery can be considered perfect which exalts lightness, or strength, or speed, or duty, or durability, or cost, or any one quality, however desirable that one may be in itself, above the harmonious blending of them all. It is much as if all the doctors in the world centred their study upon one class of diseases, to the neglect of all the other thousand ills that flesh is heir to. Doubtless the oculist thinks the eye the only member of the human body deserving attention. The aurist cannot always readily be persuaded that humanity possesses as many as five senses. The chiropodist, could he have his way, would have all the world in training for a walking match.

The human machine, when in need of reconstruction, is able to vary its doctors with its diseases. But the machinery which is intended to meet the world's mechanical wants is, in almost every case, dependent upon the skill and intelligence of a single designer or constructor. In planning machinery, therefore, it is essential that this important functionary should possess the cool hand and level head, without which skill is vain and intelligence is wasted.

The Trustees of the Brooklyn Bridge corporation are developing qualities which should entitle them to prominent mention as congressional candidates. On February 1st, not content with voting to two of their engineering officials, an increased salary of 25%, they *dated the increase back* to the first of last October, which is a thrifty way of doing things, to say the least.

Failures of Mechanical Inventions.

It is both an interesting and an amusing study to trace the development of inventions and patents through the public and private records. That there are vastly more failures than successes is nothing surprising. A shoemaker or a dry goods merchant concieves of a great improvement to the steam engine, and forthwith proceeds to take out a patent for the invention, paying $35 to the Patent Office, besides the solicitor's fees. Perhaps he spends hundreds of dollars in experimenting, in the vain attempt to get his device to work successfully; or he may wait in fond anticipation that some appreciative engine builder will buy his patent or contract to manufacture upon royalty. Substantial reward may fall to his lot, but we need hardly say that the chances of success average more than ten to one against him.

An inventor, upon taking out his first patent, naturally congratulates himself in originating a device that "supplies a want long felt." He generally learns, after sore disappointment, that the public are very unappreciative of anything that is not persistently thrust upon them.

It often happens that a practical trial of a

new invention dashes the high hopes of its originator to the ground. The trial should come before too much is staked upon the success of the invention. A little incident that will serve to illustrate this point was related by a gentleman attending the late annual re-union of the '49ers in this city. When gold was discovered in California, he formed one of a company of twenty men, who united their fortunes and set out for the distant Eldorado. They took with them a peculiar gold washing machine, built especially for their use. A heavy cast-iron box was made for the washing-trough, the bottom of which was ridged or corrugated so as to catch the gold, while the debris passed over and was thrown out at the end. A wheel, turned by a crank worked in the trough, and was arranged to have both a rotary, a lateral and a vertical motion, the combination producing a movement that was something unique.

This machine weighed 1,600 pounds, and was confidently calculated to wash out the gold with wonderful rapidity. The papers vied with each other in publishing the particulars of this machine, and the glowing prospects of the company who were to use it. Finally, after a journey by way of the isthmus, the great invention was landed in San Francisco, and nearly the whole city turned out to see it. Some even followed it to the mines, where it was carted at considerable expense, to see the operation. Upon arrival at the "diggings," $1,000 was offered for the contrivance and indignantly refused. By the time it was set up on the bank of a stream, the offer was increased, by some of the crowd of spectators, to $5,000, without making an impression upon the proprietors. When oiled and ready to start, $8,000 was offered and rejected, all the company feeling assured that with the machine it would be the work of but a few months to make a fortune. The auriferous soil was then shovelled into the washer, water turned on, and the force applied at the crank. After about three hours of diligent labor, the ingenious machine was abandoned altogether. It was a complete failure.

As our issue of December, 1877, is exhausted, we reprint this week "Sizes of Safety Valves," written for the AMERICAN MACHINIST, by Prof. R. H. Thurston, it having originally appeared in the number of that date. We have found it necessary to repeat this article, as we are constantly having calls for the number containing it. Next week we shall publish the first of a series of articles on the Safety Valve, by the well-known engineer, W. Barnet LeVan, of Philadelphia, the material for which he has been collecting for the past five years.

The Millers' International Exhibition.

An international exhibition of all kinds of milling machinery and appliances is to be held under the auspices of the Millers' National Association, at Cincinnati, O., beginning May 31st next, and continuing two weeks. The exhibition promises to be the most complete, interesting and instructive of its class that has ever taken place. There are eleven classes of exhibits, the first and most prominent of which is "motive power." The largest premium on the list, $300, will be awarded to the best automatic cut-off steam engine. A premium of $100 is also to be awarded the best slide valve engine not less than twenty-five horse power. Exhaustive test trials will be made of all the engines on exhibition. Mr. John W. Hill, of Cincinnati has been appointed chief of experts to conduct these trials This selection is wholly satisfactory to all the leading engine builders, and unusual interest is felt in the results. Six engines are to be entered for trial: the Corliss, the Wright, the Buckeye, the Brown, the Wheelock and the Harris-Corliss. A code of regulations has been published, from which we learn that all engines entered for trial will be uniformily 18 inches diameter of cylinder and worked at 600 feet piston speed. The duration of trials will be ten hours. The economy of engine will be deduced from the net weight of steam supplied during the trial; no notice will be taken of the coal actually burned in producing the steam, the boilers being worked simply to supply the required quantity of steam in best thermal condition and at uniform or constant pressure; and the cost of the power in coal per indicated and per gross load, horse power per hour, will be stated upon an evaporation equivalent to ten (10) pounds of steam per pound of coal.

Notes of the Press.

We clip the following very complimentary notice from *Y Wasg*, Pittsburgh, Pa., one of the only two Welsh newspapers published in the United States:

AMERICAN MACHINIST.—Diau nad oes wythnosolyn mwy gwerthfawr na hwn at wasanaeth y peirianydd, a chelfyddydwyr eraill, yn cael ei gyhoeddi yn y wlad hon. Cynwysa ysgrifau oddiwrth ohebwyr deall gar mewn pob cangen o beirianwaith, a cheir darluniau o'r dyfeisiau diweddaraf. Y mae yn rhwym o fod yn dda gan fod dynion mor gymhwys vn nglyn ag ef. Cyhoeddir ef vn 96 Fulton St., New York; ei bris, $3 y flwyddyn.

(*From the Chicago Journal of Commerce.*)

The AMERICAN MACHINIST, a journal for machinists, engineers, founders, boiler makers, pattern makers, and blacksmiths, is really all that its name implies, and one of the very best publications of its class that comes to our desk. At first it started as a monthly publication, but its success so soon became assured that its proprietors decided upon issuing it weekly, and it has now reached its third volume. It covers the entire ground designated above, *i. e.* in the course of its publication it treats of subjects of interest to all the above-named trades. We confess to a little surprise at the marvelous success this paper has attained since it was first ushered into existence; and yet this need not occasion surprise when the energy and determination of its publishers is taken into consideration. Each number of the MACHINIST is profusely illustrated—and handsomely, too,—with cuts of machinery of various kinds, generally embracing the newest and latest improvements, which are fully described in well written articles. The size of the MACHINIST is 16 octavo pages, and it is published by the American Machinist Publishing Co., 96 Fulton Street, New York, at $3.00 per year, in advance, postage prepaid.

(*From the Northwestern Miller.*)

One of the most valued of our exchanges is the AMERICAN MACHINIST, which we hold to be without its equal in the line of scientific mechanical papers, and which is suited alike for the engineer or superintendent, and for the workmen and apprentices in the shops. It is both original and entertaining, and there is nothing in it which is not written in a straight-forward, practical way, which the workman and mechanic cannot fail to readily understand and become better posted and better workmen for reading. It deserves the success it has attained, and should be read by every machinist in the country.

LITERARY NOTES.

THE CAR-BUILDERS' DICTIONARY.—AN ILLUSTRATED VOCABULARY OF TERMS, WHICH DESIGNATE AMERICAN RAILROAD CARS, THEIR PARTS AND ATTACHMENTS. Compiled for the Master Car Builders' Association. By Matthias N. Forney, M. E., of the *Railroad Gazette*, assisted by Leander Garey, Sup't. of the Car Department, N. Y. Central & Hudson River Railroad, and Calvin A. Smith, Secretary of the Master Car Builders' Association; 490 pages, with 800 engravings; size, 5½×8 inches. Price, $2.00. Published by the *Railroad Gazette*, 73 Broadway, N.Y.

A committee of the Master Car Builders' Association were appointed some years since, to collect matter for a dictionary, in order to establish a uniform system of names of the different parts of cars.

Much confusion has existed upon railroads (which has been constantly increasing) ever since it was found necessary to exchange cars from one road to another, which is commonly known as the interchanging of cars. The principal trouble in connection with this was, that every road had a different name for the same part of a car, and on some roads even the men in charge of the different divisions would puzzle each other in the same way. In ordering a certain piece, one would call it by a name unknown to the other. For example: a "draw-bar" is called a "pull-iron" in one section, a "shackle-bar" in another, while in a State not far from New York, it is known by the euphonious name of a "bull-nose." A "journal-box" in one place, means the brass bearing which it rests on, and is exposed to the friction of the axle journal, while at other places it means the cast-iron box which encloses the axle and its bearing, also holding the lubricating material. We might thus mention a host of similar cases; and any person acquainted with railroads can at once realize the bedlam into which the railroads were thrown through the want of a vocabulary of uniform terms. The master car-builders, being the greatest sufferers, began the work of supplying this want, and have succeeded nobly. The book bears the evidence of earnest labor, for which their committee deserve great credit, as their time was taken from the usual individual duties, as could be best arranged. The work is arranged alphabetically, and has cross-references, by means of which, with the illustrations, the name of any part of a car can readily be found.

This dictionary contains about 2,500 words and their definitions. A large portion of the engravings are made to a scale, and illustrate all the different parts of railroad cars, and is at the present time the only work extant on American cars. It will doubtless find many warm friends among the railroad men of this country.

Business Specials.

Forty cents a line for each insertion under this head.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, Piermont, N. Y.

Models made to order; experimental machinery built; parts of models supplied. H. B. Morris, Ithaca, N. Y.

Light machinery contracted for. Slide Rests a specialty. W. C. Young & Co., Worcester, Mass.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) W. S. T., Jersey City, N. J., wants to know what is the best substance to fasten rubber on iron band saw wheels, so it will hold securely? Have tried shellac varnish, copal varnish, and glue without success. *A.*—Use gum arabic and plaster of Paris. Mix until it is viscid enough to apply well.

(2) E. O. H. writes: A four-inch double belt is driving a cylinder, and has all it can do; slips so much that it wears out very quick. We propose to run by belting, to a pulley and a stud, with a crossed belt, and drive cylinder by a small pinion on pulley hub or bushing, to a gear wheel on cylinder shaft; speed of cylinder to remain the same. Shall we gain anything, and in what way? Can we use a light belt? *A.*—Cover the face of the pulleys with leather, and use a single six-inch belt.

(3) L. I., Lexington, Mass., writes: Will you please inform me at what speed a piston with metallic rings, steam-packed, should move to give best results? Also, what is the greatest speed of piston recommended by the advocates of high piston speed? *A.*—The speed at which a piston should travel depends greatly upon the stroke of the engine; for instance, an engine having a stroke of four feet might travel at the rate of 1,000 feet per minute, but we doubt if any of the advocates of high piston speed would care to run an engine of 12″ stroke at the above-mentioned piston speed at 500 revolutions per minute. The practice generally adopted by those who favored such high speeds, is 600 feet for engines under 30″ stroke, and 1,000 to 1,200 feet for engines over 36″ stroke.

(4) Machinist, Boston, Mass., asks: 1st: How tight do they fit the valve to the cylinder of a piston valve? 2d. How do they grind the inside of the cylinder? 3d. Is it a first-class valve when worked in a vertical position without packing rings? *A.*—1st. When a piston valve is fitted as a simple plug, without packing rings, to the cylinder in which it works, it is the usual practice to fit it so that it can be worked back and forth by hand, and without any shake transversely; but care must be taken in starting the engine, that the steam is allowed to warm both valve and casing uniformly, or else there will be danger of it jamming. 2d. The inside of the cylinder is not ground, but carefully bored and seamed with cutters in a boring-head, on a true boring bar. 3d. Experience says so. In practice it has been found that there is a tendency for the valve to wear the cylinder or casing, in the direction in which the steam leaves the valve cylinder, for the piston cylinder, causing it to become oval in form, and consequently leaky, thus neutralizing all the advantages attending the use of a piston valve. Packing rings will not help this trouble, for wherever they have been used they have been ultimately discarded.

(5) F. B., Exeter, N. H., writes: Suppose we have an engine with four-inch cylinder, and six inches stroke, and we put a piston (piston-rod we supposed) in that will take up two square inches, and run it at a 100 lbs. steam pressure; will the engine have 200 lbs. more working force on the end that the piston does not connect with the rod, than on the end it does connect? *A.*—Certainly. The piston-rod side of the piston has an area of 12.56 square inches, minus area of rod=2 square inches=10.56 square inches multiplied by 100, the number of the pressure=10.56 lbs. pressure. The opposite side of the piston has an area of 12.56 square inches multiplied by 100, the number of lbs. pressure=12.56 lbs.

MANUFACTURES.

Flather & Co., Nashua, N.H., are employing twenty hands, running full time, and are full of orders. They will soon commence to build an addition to their shop.

Wiley & Russell M'f'g Co., Greenfield, Mass, are running about fifty hands on full time; have plenty of orders and doing well.

P. Pryibil, 461 West 40th St., N.Y., has recently brought out some improved wood-working machinery. He is pressed with orders, and contemplates making an addition to his shop.

The Carbon Iron Company at Perryville, Pa., are to build another foundry, so as to turn out the work that is required at short notice. About five hundred hands will be employed when the foundry is complete.

Lorin P. Pennet has purchased a mill site at Appleton, Wis., and next spring will commence the erection of a large merchant and flour mill. Appleton is looming up as a milling centre.

The wages of the hands employed in the Hunterdon Factory, at Glen Gardner, N. J., have been increased ten per cent.

The employees of the Cumberland Nail and Iron Works at Bridgeton, N. J., are to have an increase in wages, dating from February 1st.

Wilson, Walker & Co., of the Union Forge and Iron mills, at Pittsburgh, have lately added a 200 lb. helve hammer to their forge department. An addition, 72x74 feet, is being built for a new 4,900-pound steam upright hammer.

The Merchants' Manufacturing Company of Fall River, Mass., are about to erect a one-story building adjoining the mill, to be used as a machine shop and cloth room.

The Lowell Machine Shop of Lowell, Mass., will this spring enlarge their foundry so as to employ twenty-five more men.

The Knowles Steam Pump Company of Warren, Mass., are building an addition of fifty feet to their mill. They now employ 160 hands.

Sayles & Owen are enlarging their woolen mill at Warren, Mass.

The moulders at the works of the Ellis Foundry Company at Carver, Mass., have had their wages advanced 5 per cent.

It is reported that G. W. Bent of West Bridgewater, Mass., contemplates the removal of his iron foundry business to Brockton.

The Putnam Machine Company of Fitchburg, Mass., have built an addition to their iron foundry, 50x36 feet, and are increasing the number of workmen.

The Deane Steam Pump Company of Holyoke, Mass., are at work on a large vacuum pump for grape-sugar works at Peoria, Illinois.

There is to be a large Beet Sugar Works erected in Oswego, N. Y., this coming season.

The Bartholomay Brewing Co., Rochester, N. Y., have just set three boilers with the Jarvis Patent Furnace.

The Tweedy M'f'g Co., Danbury, Conn., have set three Lowe & Watson boilers with the Jarvis Furnace to burn screenings without a blower. These boilers are set the same as common tubulars, and fire underneath the shell.

The Pittsburgh Locomotive Works having started up again the first of the year, are now building 10 locomotives for the Atlantic and Great Western Railroad, also 12 more for the Texas Pacific.

Krupp's rail mill at Essen, Germany, is full of orders, and will not take any more for delivery until after July, 1881.

A Hartford firm has become owner of a new "multiple" telegraph system, which far outstrips the "quadruplex" system. Paupers Vanderbilt and Jay Gould have been investigating its merits.—*Brooklyn Times.*

Blake & Johnson of Waterbury, Conn., are to erect a large factory to occupy the site in front of their present shop; work upon which will be commenced in a few weeks.

C. E. Marston, of Dover, N. H., has just finished a new building for a machine shop in connection with his foundry.

Orr, Hess & Morgan, of Philadelphia, are building a new motor for propelling street cars. They claim that they can run the largest street car on any grade with a one-horse-power engine. It will be known as the Kelly motor.

The Hinckley Locomotive works at Boston, have been bought by Mr. Alexander H. Porter, the agent. The price was $201,000 over two mortgages of $180,000 and the tax for 1879.

The rollers employed by Lewis, Oliver & Phillips, at Pittsburgh, Pa., have received an advance of 10 per cent. in their wages.

The Syracuse, N. Y., Cutlery Works is a new enterprise, which will employ several skilled mechanics.

The Stow Flexible Shaft Company, Limited, of Philadelphia, have just supplied the Grand Trunk railway shops with their flexible shafts, to be used in drilling and tapping stay-bolt holes in locomotive fire-boxes, which has heretofore been done by hand.

The Utica Steam Cotton Mills, Utica, N. Y., are to build another mill and enlarge the present No. 1 mill one hundred by seventy two feet.

The St. Charles Car Works have just built an extension, 200x76 feet, to their erecting shop. It will have a total length of 375 feet, and has four tracks, with a capacity of 50 cars at the same time.

The Harmony Cotton Manufacturing Company of Cohoes, N. Y., run 6,200 looms, making annually 500,000 miles of cotton cloth twenty-eight inches wide.

The White Sewing Machine Company, Cleveland, O., have purchased 300 feet more ground, adjoining their present large factory, on which they intend to build an addition to their works.

The Weed Sewing Machine Company, of Hartford, Conn., are running their extensive works to the extent of their capacity, and are adding machinery to enable them to keep pace with steadily increasing orders for goods of their manufacture. They are the sole makers in the United States of bicycles, under the patents held by the Pope Manufacturing Company, and are preparing to turn out several thousand this year. The fine forging department is running extra time to fill orders for the Walter A. Wood Manufacturing Company and others of their patrons. —*Boston Commercial Bulletin.*

A. H. Andrews & Co's school furniture factory in Chicago, which was burned Nov. 25th, is now almost rebuilt, and will be ready for occupancy early in January. It will occupy the same ground and be of the same dimensions as before, but the interior arrangements will be somewhat different and more convenient. Since the fire they have been operating their factory at Mishawaka, Ind., employing over a hundred men. They will probably continue to operate this branch factory permanently.

It is thought that the West Jersey and Atlantic City Railroad will put their shops at Newfield, N. J. They are buying desirable land there.

A mammoth 32 page issue of the Denver (Col.) *Tribune* contains the following:

Eighteen months ago Messrs. Arthur Hendey, of Wolcottville, Conn., and Herman H. Meyer, established the Excelsior Steam Engine Works. Mr. Hendey is a practical machinist, having an interest in a large machine shop of similar nature in Connecticut, while Mr. Meyer is a skillful pattern-maker. They employ eighteen hands, who are kept constantly busy, the works being strained to their utmost capacity to meet the demands of the trade. Messrs. Hendey & Meyer manufacture all sizes of stationary engines, and of a class that will compare favorably in all respects to the works of the most noted builders. They are also large manufacturers of mill gearing and mining machinery. Their chief specialty is the manufacture of their own patent steam engines, with or without automatic cut-off-gear. The fast increasing business of this establishment constantly requires the increase and improvement of facilities, and it is not a hazardous prediction that the enterprise of these industrious young gentlemen will soon become one of the most extensive of the kind in the West. To this end the rapid development of the state is a positive guarantee, while under so skillful a management, aside from other considerations, their venture is an assured success.

Machinists' and Engineers' Supplies.

NEW YORK, Feb. 6, 1880.

Business in this branch is more steady this week.

Sheet brass and copper, also brass and copper wire, remain unchanged, although ingot copper has fallen ½ cent per pound, being now 24¼ c.

Brass and copper tubing remain unchanged. No list is published yet. The market is stiff, and the manufacturers look for higher prices.

Peter Wright's anvils have advanced ¼ cent per pound, and tendency is still upward. Vises are quoted as follows: Peter Wright's, 16 c. per pound; American Crown, 14 c. per pound.

The market is pretty well cleaned out of machine screws, and it is impossible to fill orders for machine tapped nuts at present.

Machine bolts are also hard to find.

James Beggs & Co., 8 Dey Street, have taken the sole Eastern agency for the Gardner Governor, and are also selling agencies for the Root Machinists' and Black-miths' Blowers. Prices on these blowers, we are informed, have advanced 10 per cent. A new pattern of Root Blower is now being made, wherein the wood has been abandoned, and the parts are made exclusively of iron, steel, and bronze.

The manufacturers of the Cushman chuck are about to issue a new price list.

Boiler tubes remain unchanged. The market is stiff, and prices are expected to advance.

The Billings & Spencer Co. send us the following, which they are sending to their customers.

HARTFORD, CT., Jan. 26, 1880.

DEAR SIRS:—We quote you herewith new line of discounts from our Price List, to take effect on and after this date.

	Per Cent.
Screw Plates, Dies and Taps	30
Lathe Dogs	33⅓
Counter Sinks	33⅓
Screw Drivers	33⅓
Packer Ratchet Drills	50
Barwick Wrenches	33⅓
Marlin spikes and Calkers Tools	33⅓
Adjustable Pocket Wrenches	33⅓
Tap Wrenches	30
Beach's Thread Cutting Tool	33⅓
Slates' Cutting-off Tool	25
Carew Wire Cutter	20
Combination Plyers	33⅓
Tracing Wheels	50
Drop Forgings as per List	20

Yours, &c.,

THE BILLINGS & SPENCER CO.

Iron Review.

NEW YORK, Feb 5, 1880.

The general state of the market is unchanged from our last report, with no evidence of lower prices, either on the part of the mills or dealers. The tendency is still upward.

Pierson & Co., 24 Broadway, New York, furnish us the following quotations out of store, under date of Feb. 5, 1880.

No. 1, X Pig, $42½ per ton; Iron Rails, $68 to $70, according to weight; Old Rails $44 to $45; Fish Plates, 4c. per lb.; Railway Spikes, 4¼c.; Bolts and Nuts, 5½c.; Common Bar Iron, 3 5-10c., basis from store; Refined, 3 8-10c., basis; Ulster, 5c., basis; Machinery Steel, 7c.; Best Tool Steel, 13½c., Norway Bar Iron, 6¾c.; Norway Shapes, 6¾c.; Nail Rods, 7c.; Sheet Iron, 5c., basis; Angle Iron, 4 3-10c.; Tee Iron, 4 8-10c; Band Iron, 4½c.; Hoop Iron, 4 6-10c.; Horse Shoe Iron, 4½c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets 30% off in papers, 10% off in bulk.

Store prices to-day of boiler-makers supplies: Flange, 6¼c.; C. H. No. 1 Shell, 5¼c., C. No. 1, 4¾c.; Sheets, 5c. basis.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of Feb. 5, 1880:

Comparative dullness has pervaded the Metal Market during the past week, and the indications now are that we are on the eve of renewed activity. Jobbing trade continues fair. Pig Tin in London, active and excited, £96.10/ at this writing; Singapore, $31. We quote spot market, nominally: Banca Tin, 26c.; Malacca & Straits, 24c.; Australian & Billiton, 23⅞c. to 24c.; "Lamb & Flag," 23¾c.; Bar Tin, 25c.; Pig Lead, 6¼c., strong; Antimony, 20c. to 23c., as to brand; Ingot Copper, 24¼c.; Spelter, 6¾c., for either domestic or Silesian: Nickel, $1.25; No. 1 Solder, 13½c.; "Half-and-half," 15½c.

Situations Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 words), at the nominal rate of twenty-five cents for each insertion.

WANTED.—50 good machinists and a few boiler makers. Good wages and plenty of work. Address or call at once on W. F. Parish, Supt. Stearns Mfg. Co., Erie, Pa.

WANTED—Situation as foreman over a Machine Shop by a well qualified man. Address W. Fitton, Mount Washington, Bedford Street, Pittsburgh, Pa.

WANTED—A situation by an able and active mechanic and draughtsman of many years experience. Is thoroughly conversant with the Corliss system and the construction of special tools. First-class references given if required. Address A. P., American Machinist, 96 Fulton Street, N. Y.

TO ENGINE BUILDERS &c. A strictly first class man, well up in all modern steam economy, will be open, by the 1st of March, for an engagement, as Superintendent or manager. Middle or Southern states preferred. Address, J. W., care American Machinist, 96 Fulton St., N. Y.

A competent man, who has been machinist, engineer, and master mechanic, wants a position as master mechanic or superintendent of machinery. Best references. Address, A. V., care AMERICAN MACHINIST, 96 Fulton St., New York.

An experienced practical Mechanical Engineer and Draughtsman, competent to design general or special machinery in the best manner, desires an engagement. Address J. J. H., AMERICAN MACHINIST office, 96 Fulton street, New York.

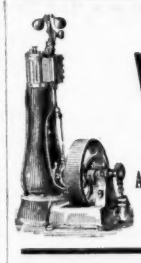
PATENT NICKEL-SEATED
"POP" SAFETY VALVES
FOR
STATIONARY, LOCOMOTIVE, MARINE and PORTABLE
STEAM BOILERS.

Our Patents cover all Safety Valves utilizing the recoil action of steam, and familiarly known as "Pop Safety Valve."

☞ Purchasers, beware of infringements of our Patents. ☜

Capital, $100,000.
The Consolidated Safety Valve Co.,
Office and Manufactory,
51 & 53 SUDBURY ST., BOSTON, Mass.

THE DIXWELL IMPROVEMENTS
For working Engines with
SUPERHEATED STEAM
Will reduce the consumption of fuel in non-condensing engines working under conditions otherwise favorable to economy, to 2.5 lbs. of coal per 1 H. P. per hour, and in condensing engines to 1.75 lbs. of coal per 1 H. P. per hour.
Prevent the waste from Cylinder Condensation, which, tests show, amounts in every engine running to from 20 to 40%.
We will test, free of charge, engines now running, and show parties desiring to examine the Improvements how much they can save.
GEO. H. BARRUS, Agent,
553 Shawmut Ave., Boston,
Send for Circular and Pamphlets.



TWISS
Vertical Engine.
For all light, quick work. Size, 2 to 20 horse power. Also,
Special Yacht Engines
And the Twiss Patent Automatic Engine.
Manuf'd by NELSON W. TWISS,
NEW HAVEN, CONN.

MACHINE
DRAWING COPIES
TEN CENTS EACH.
Send for List of Plates, now ready, and Catalogue of Books for Practical Engineers.
E. & F. N. Spon, 446 Broome St., N. Y.

S. & C. WARDLOW,
SHEFFIELD, ENGLAND,
SOLE MAKERS OF THE SPECIAL BRAND
TOUGH
CAST STEEL,
For Turning and other Tools,
ALSO DIES, ETC.
Branch Office & Stores: 95 John St., New York.
WILLIAM BROWN, Sole Agent.

RICHARD DUDGEON,
24 Columbia Street.
NEW YORK,
Maker and Patentee of
IMPROVED HYDRAULIC JACKS,

Punches, and Roller Tube Expanders,
AND
DIRECT ACTING
Steam Hammers.
Communications by letter will receive prompt attention.
Jacks for Pressing on Car Wheels or Crank Pins made to order.

THE
HANCOCK INSPIRATOR CO.
MANUFACTURERS OF
INSPIRATORS, EJECTORS,
—AND—
GENERAL JET APPARATUS,
34 Beach Street, Boston, Mass.
35 Queen Victoria St., London, England.

NICHOLSON FILE CO.

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS and SPECIALTIES.

"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files.
"Slim" Saw Files.
"Racer" Horse Rasps.
Handled Rifflers.
Machinists' Scrapers.
File Brushes, File Cards.
Surface File Holders,
Vise File Holders.
Stub Files and Holders.
Improved Butchers' Steels.

Manufactory and Offices at PROVIDENCE, R. I., U. S. A.

NEWARK STEEL WORKS.

BENJAMIN ATHA & CO.

MANUFACTURERS OF

CAST STEEL

WE MAKE GRADES OF STEEL SPECIALLY ADAPTED TO THE MANUFACTURE OF LATHE TOOLS, CHISELS, TAPS & DIES

BENJ. ATHA. NEWARK, NEW JERSEY. J. ILLINGWORTH.

The Workshop Companion.

A handy and useful dictionary of practical information for **Engineers, Machinists, Draughtsmen and Mechanics**, containing useful and reliable recipes, rules, processes, methods, practical hints, &c. **NO** medical or cookery recipes. 164 pages. This book will be sent, post-paid, on receipt of Twelve 3-cent postage stamps.

T. P. PEMBERTON,
249 Duffield St., Brooklyn, N. Y.

The Rollstone Machine Co.

FITCHBURG, MASS.

Manufacture sixty different machines, embracing all varieties of

WOOD WORKING MACHINERY.

Send for circulars of any special machines wanted. We also carry a large stock of Second-Hand Machinery. Send for Catalogue.

Books for Practical Men.

HEAT, as applied to the Useful Arts, for the use of Engineers, &c. By Thomas Box, 8vo. cloth, $5.00

ELECTRIC LIGHT in its Practical Application. By Paget Higgs. 94 Illustrations of Lamps. Regulators and Generators, 8vo. cloth, $3.50.

CASTING AND FOUNDING. Including descriptions of the Modern Machinery employed in the Art. By N. E. Spretson, 82 plates, 8vo. cloth, $7.00.

ALGEBRA Self-Taught. By Paget Higgs, 8vo. cloth, $1.00.

ELECTRIC TRANSMISSION of Power; its present position and advantages. By Paget Higgs, 8vo. cloth, $1.20.

STEAM ENGINE; containing Plans and Arrangements of Details for Fixed Steam Engines, with Essays on the Principles involved in Design and Construction. By Arthur Rigg. 96 plates and numerous engravings. Strongly bound in half mor. $17.00.

STEAM ENGINE; considered as a Heat Engine. By Jas. H. Cotterill. Giving Diagrams, Tables, and Examples from Practice. 8vo. cloth, $5.00.

OPERATOR'S HANDBOOK. On the Arrangement, Care, and Operation of Wood-working Factories and Machinery. By J. Richards. 8vo. cloth, $1.50.

A descriptive Catalogue and Circulars sent free by mail on application. Our own and other Publishers Books sent free by mail on receipt of price.

E. & F. N. SPON, 446 Broome Street. New York.

Machinists' Supplies,

CHAMPLIN & SPENCER,
154 E. Lake Street,
CHICAGO, Ill.

Sole Agents for the Tanite Co.'s Solid Emery Wheels, Grinding Machinery, &c.

Also, agents for **Shepard's Screw Cutting Lathes** Dealers in Morse Twist Drill Co.'s Goods and small tools for all workers in iron or wood. Send for Catalogue.

To Manufacturers.

We are prepared to furnish

Recipes and Information

ON ALL

INDUSTRIAL PROCESSES.

Address

PARK BENJAMIN'S SCIENTIFIC EXPERT OFFICE,
37 Park Row, - NEW YORK CITY.

Drawing Instruments

AND MATERIAL, PAPER, &C.

G. S. WOOLMAN,
116 Fulton Street, New York.

Fully priced and illustrated Catalogues.

ALMOND DRILL **CHUCK**

Made of Steel throughout, equal to doing any work required of it—Runs perfectly true.

For sale by all Machinists' Supply Stores.

T. R. ALMOND
84 Pearl St.
BROOKLYN, N.Y

(Cut shows Chuck full size.)

HALL'S PATENT

DOUBLE COMPOUND LEVER CUTTING NIPPERS.

MACHINISTS' SUPPLIES.

Price $1.25.
Sent by mail for 6 cents additional.
Every pair warranted.

Of the many Cutting Nippers heretofore placed on the market, not one has supplied either of the two great needs long felt by all who use them, viz.: 1st. Increased power without a clumsy and expensive increase of size. 2d. That the construction of the Nipper should be such that any damage to the cutting jaw or handle, from wear or accident, could be repaired.

All orders should be addressed to

PETER A. FRASSE & CO., Sole Agents, 95 Fulton Street, New York.

More than 6000 in Use July 1st, 1879.

The Best **STEAM PUMP** in America.

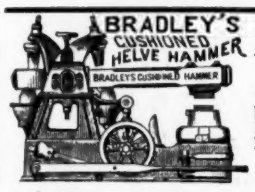
SIMPLE! POSITIVE! DURABLE! **"THE DEANE."** FOR EVERY POSSIBLE DUTY.

Send for Illustrated Catalogue and Price List.

DEANE STEAM PUMP COMPANY,
Holyoke, Mass., U. S. A.

N. Y. WAREROOMS, 92 & 94 LIBERTY ST.

JOHN H. HARRIS, Manager.



BRADLEY'S CUSHIONED HELVE HAMMER.

Awarded first premium, Silver Medal at American Institute Fair, 1873, Cincinnati Industrial Exposition, 1874, and the Diploma of Honor and Grand Medal of Merit at the Centennial Exhibition, in 1876,

Being the highest award given any goods of their class in America or Europe.

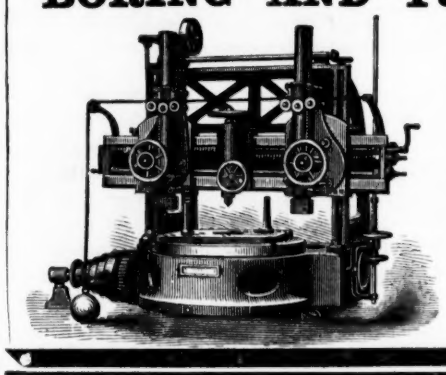
IT HAS MORE GOOD POINTS, LESS COMPLICATION
MORE ADAPTABILITY, LARGER CAPACITY,
DOES MORE AND BETTER WORK, TAKES LESS POWER
COSTS LESS FOR REPAIRS.

THAN ANY HAMMER IN THE WORLD.

Guaranteed as represented. (Established 1832.)

Branch Office, 22 to 24 & 26 So. Canal Street, CHICAGO, ILL. BRADLEY & COMPANY, Syracuse, N. Y.

BORING AND TURNING MILLS.



All Sizes: 4, 5, 6, 8, 10, and 12 feet Swings.

PATENTED IMPROVEMENTS.

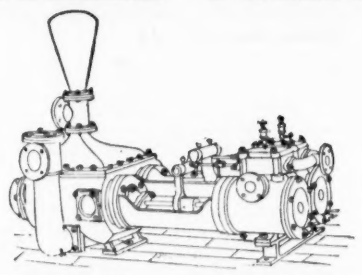
New Patterns.

MACHINISTS' TOOLS,

The Latest and Best, at very moderate prices.

NILES TOOL WORKS, HAMILTON, OHIO.

STEAM PUMPS.



HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water Street, Boston.

THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water Works Stations.

Worthington Steam Pumps of all Sizes and for all purposes.

PRICES BELOW THOSE OF ANY OTHER STEAM PUMP IN THE MARKET.

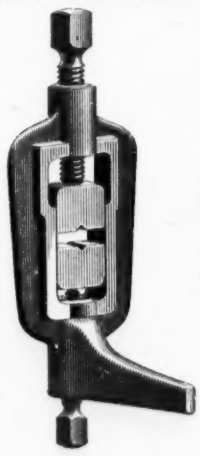
WATER METERS. OIL METERS.

FOR SALE—500 malleable Iron Lamps, with Iron Burners, suitable for Machinists and Boiler-makers' use. Price $5 per dozen. W. Walter, 41 West 35th St., New York.

C. W. LeCOUNT,
SOUTH NORWALK, CONNECTICUT,
Manufacturer of

LeCount's Die Dogs,

Have a Steel Frame, with two screws, so as to throw the center of Die the same distance from tail of Dog on a small piece as on a large. The Dies are hardened, and a good job with Hardened Steel Screws. Extra Dies can easily be fitted to suit any special work, or will be furnished as below:



PRICES.

	EXTRA DIES.	OPENS.
No. 1,	$1.25	½ Inch.
" 2,	1.00	¾ "
" 3,	2.00	1 "
" 0, Amateurs or for ¼ lathes	1.25	¾ "

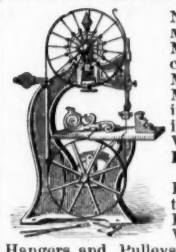
When ordering Extra Dies please state which you require, the V or Tongued.

WOOD WORKING MACHINERY.

J. A. FAY & CO.,

BUILDERS OF

IMPROVED MACHINERY FOR WOOD CUTTING.



Numbering some 300 different Machines—Planing and Matching Machines, Surface Planing Machines, Molding and Tenoning Machines, Mortising and Boring Machines, Carving and Dovetailing Machines, Shafting and Friezing Machines, Horizontal and Vertical Boring Machines.

Improved Variety & Universal WOOD WORKERS.

Band, Scroll, Ripping and Cutting-off Saws, Band and Circular Resawing Machines, Spoke and Wheel Machinery, Shafting, Hangers and Pulleys, etc., etc. Original in design, simple in construction, perfect in workmanship, saves labor, economizes lumber, and its productions are of the highest standard of excellence. ***Send for Circulars and Prices.***

J. A. FAY & CO., Cincinnati, Ohio, U.S.A.

THE ECONOMIZER ENGINE

Comprises Efficiency, Durability and Economy. Has more improvements than any engine in the market. Send for Catalogue.

S. L. HOLT & CO.,
67 Sudbury St., Boston, Mass.

S. C. FORSAITH & CO.,

MANCHESTER, N. H.

AND

213 CENTRE STREET, N. Y.

SPECIALTIES:

Abbe Bolt Machines,

POWER HAMMERS,

Combined Hand Fire Engine and Hose Carriage.

NEW AND SECOND-HAND MACHINERY.

Send stamp for Illustrated Catalogue, stating fully just what you want. Over 2,000 machines, new and second-hand; fully described, with prices annexed, in our List No. 20.

Address P. O. Box 2187. **PIERSON & CO.** Office, 24 Broadway, N.Y

ESTABLISHED 1790.

IMPORTERS AND DEALERS IN

IRON and STEEL of every Description.

Warehouse, 24 & 26 Broadway, and 77 & 79 New Street.

PRICE LISTS FURNISHED ON APPLICATION.

P. BLAISDELL & CO.,

MANUFACTURERS

MACHINISTS' TOOLS,

Blaisdell's Patent Upright Drills

With Quick Return Motion.

Engine Lathes, Planers, Boring Mills, Gear Cutters and Hand Lathes.

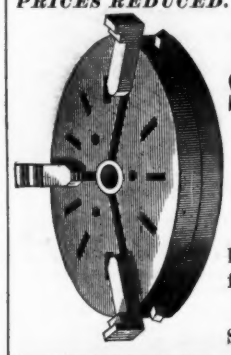
WORCESTER, MASS.

Please state where you saw this Advertisement.

The E. HORTON & SON CO.

WINDSOR LOCKS, CONN.

PRICES REDUCED.



MANUFACTURERS OF

THE HORTON LATHE CHUCK

AND THE

SWEETLAND IMPROVED HORTON CHUCK,

Independent, Universal and Eccentric Combination.

April 1st, 1879.

From this date a discount of 30 per cent. will be made from the list price of The Horton Lathe Chuck, and a discount of 15 per cent. from the list price of the Sweetland Improved Horton Chuck.

Soliciting your orders, we are, respectfully yours,

Send for Price List. THE E. HORTON & SON CO.

H. PRENTISS AND COMPANY

Manufacturers of PATENT RELIEVED

Machinists', Blacksmiths' and Gas Fitters'

Taps; Dies, Reamers and Screw Plates, &c., &c.

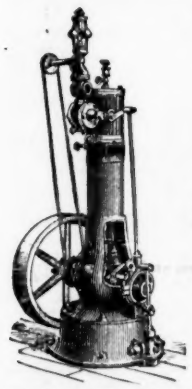
DEALERS IN MACHINISTS' SUPPLIES.

No. 14 DEY STREET, - NEW YORK.

W. H. ODELL, ENGINES INDICATED, POWER MEASURED.

BOX 274, YONKERS, N. Y.

Vertical and Yacht Engines.



The Rowland

Vertical Engine.

LARGE WEARING SURFACES.

Simple in Construction.

JAMES BEGGS & CO.

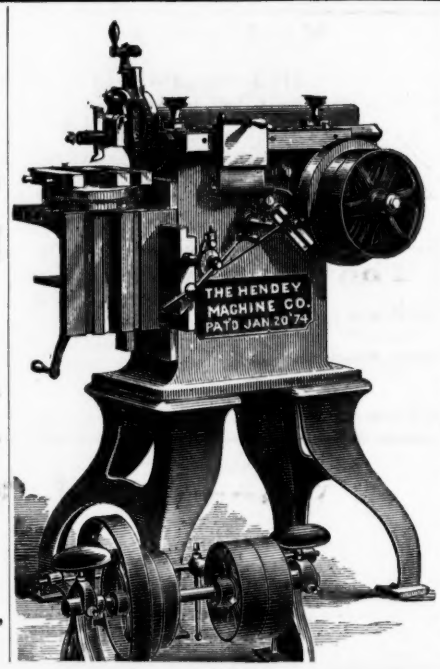
New York Agents.

8 DEY STREET,

NEW YORK.

F. C. & A. E. ROWLAND, Engineers,

NEW HAVEN, CONNECTICUT.



The Hendey Machine Co.

Wolcottville, Conn., U. S. A.

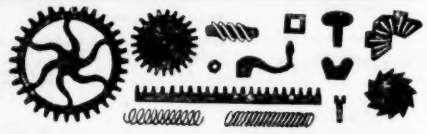
MANUFACTURERS OF THE

MANVILLE PATENT IRON

Planers and Shapers.

24 in. Shapers, 15 in. Shapers, 5 ft. x 24 in. Planers, 3½ ft x 16 in. Planers, 24 in. Amateur's Hand Planers, with Chuck and Centers, 3 ft. x 8 in. Fine Engine Lathes, 5 ft x 12 in. Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck and Common Clock Lathes.

☞ Send for Catalogue giving description of Tools, with names and opinions of users, and mention where you saw this.

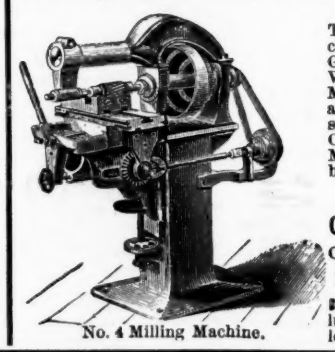


Small Tools of all kinds: GEAR WHEELS, parts of MODELS, and materials of all kinds. Catalogues free. GOODNOW & WIGHTMAN, 176 Wash'ton St., Boston, Mass.

E. E. GARVIN & CO.

Manufacturers of

Milling Machines, Drill Presses,



No. 4 Milling Machine.

Hand Lathes, Tapping Machines, Cutter Grinders and Wood Planers. Milling Cutters, all shapes and sizes. Gear Cutting and Millingin all its branches.

139-143 CENTRE ST.

Cornell's B'ld'g

NEW YORK.

☞ Send for illustrated Catalogue.

TRADE GODDARD MARK

THE

Goddard Emery Wheel,

E. A. GODDARD,

Gen. Sales Agent.

ALSO AGENT FOR

AMERICAN TWIST DRILL CO'S

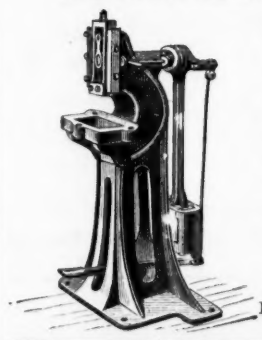
Emery Grinders.

DEALER IN

MACHINISTS' SUPPLIES.

Warerooms, 176 FULTON STREET, NEW YORK.

ASTONISHING POWER in FOOT and HAND PRESSES.



Punching, by foot, *3-4* hole in *5-16* iron 6 inches from edge.

Smaller sizes punch, by foot, *3-8* x *1-4*, and *1* inch by *1-8*, as rapidly as by power presses, at one-half the cost.

Our largest hand machines punch *1* inch hole in *3-8* iron, and shear bar *3-4* x *2* inches at a cut, any length, one man at the lever.

Highest prize, ***The Grand Medal of Progress***, has just been awarded us at the American Institute Exhibition.

Our presses can also be run by steam power.

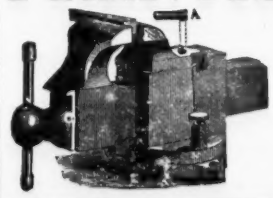
PEERLESS PUNCH and SHEAR CO.,

52 Dey Street, New York City.

STEREOTYPES & ELECTROTYPES
ORIGINAL DESIGNS AND SKETCHES
U.S. ENGRAVING WORKS
RELIEF PLATES FOR NEWSPAPER AND BOOK ILLUSTRATIONS
CHEAP AND SUPERIOR SUBSTITUTES FOR WOODCUTS
NEW YORK

TOOL DEPOT
CHUCKS, VISES, FILES, EMERY GRINDERS, EMERY WHEELS, WIRE
STEEL, BRASS, TAPS, DIES, MACHINE
SET & CAP SCREWS, GEAR WHEELS, LATHES
SHAPERS, DRILLS, SCROLL SAWS & SMALL TOOLS
FOR ALL BRANCHES OF TRADE. SEND FOR CATALOGUE
& STATE WHAT KIND OF TOOLS YOU REQUIRE.
TALLMAN & McFADDEN. PHILADELPHIA.

PRENTISS PATENT VISES,



ADJUSTABLE JAWS,

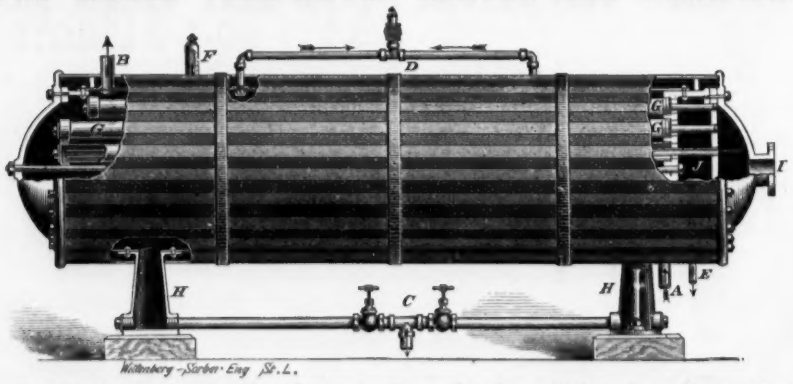
Stationary and Patent Swivel Bottoms,

Adapted to all kinds of Vise work.

HALL M'F'G CO., 23 DEY ST., NEW YORK.

SEND FOR CIRCULAR.

THE MORSE FEED-WATER HEATER AND PURIFIER.



Wilkinsburg - Barber Eng Co. L.

Guaranteed to be the most perfect device in the market for utilizing the exhaust of steam engines. For further particulars, address

E. L. MORSE Mechanical Engineer, 313 Olive Street, St. Louis, Mo., or J. F. WANGLER, St. Louis Boiler Works.

Stoves and Fire-Place Heaters,

COMBINING

THREE THINGS IN ONE APPARATUS:

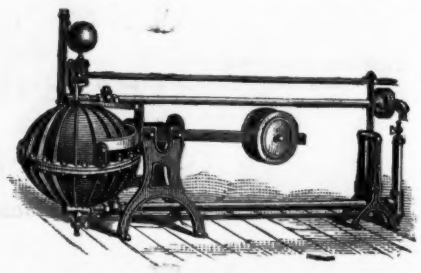
Open Fire, Close Stove, Warm Air Furnace.

Send for descriptive catalogue and testimonials from highest scientific and practical authorities in this country.

OPEN STOVE VENTILATING CO.

78 Beekman St., New York.

THE ALBANY STEAM TRAP.



This Trap automatically drains the water of condensation from HEATING COILS, and returns the same to the Boiler, whether the coils are *above or below* the water level in Boiler, thus doing away with pumps and other mechanical devices for such purposes.

Apply to

Albany Steam Trap Co.

ALBANY, N. Y.

ESTABLISHED 1848.

WILLIAM SELLERS & CO.

PHILADELPHIA.

Machine & Railway Shop Equipments

Shafts, Couplings, Hangers, Pulleys, Mill Gearing, Etc.

Lathes, Planers, Drills, Shapers, Bolt Cutters, Etc.

Railway Turntables & Pivot Bridges. Gifford Injectors, Sellers' Improvements

NEW PATTERNS. SIMPLE, EFFECTIVE

New York Office, 79 Liberty Street.

THOS. PROSSER & SON, 15 Gold St., **NEW YORK.**

"Prosser" Boiler Tube Expanders

STEEL SCREW PUNCHES, TUBE BRUSHES, &C.

WONDERFUL PUNCHING.

D. L. KENNEDY'S

Spiral Shearing Punch

THE

DRILL

AND REVOLVING CUTTER

SUPERSEDED,

AND THE WORK

2½ TONS PER SQUARE INCH

STRONGER than with the FLAT PUNCH.

Can be used in any Punching Machine, by license from the patentee.

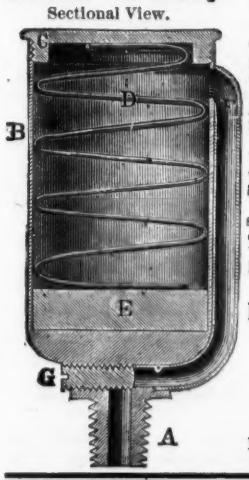
D. L. KENNEDY,

10 Cortlandt St., New York.

CAUTION.—Infringements will be rigorously prosecuted.

Loose Pulley Lubricator.

Sectional View.



The only reliable automatic Loose Pulley Oiler in the World.

Saves Oil, Belting, Machinery, Time, soiling of Fabrics, &c., &c. Will run from one to three months with once filling. Gives general satisfaction.

For illustrated description see April issue of American Machinist, 1879, or send for circular. Address

Loose Pulley Lubricator Mf'g Co.

P. O. Box 1030.

MIDDLETOWN, CT.

ENGRAVING ON WOOD

D. H. TUTTLE 5 BEEKMAN ST. N.Y.

Mechanical work a Specialty.

FOR AUTOMATIC CUT-OFF FIXED CUT-OFF & SLIDE-VALVE

STEAM ENGINES

ALSO BOILERS ADDRESS WOODBURY BOOTH & PRYOR ROCHESTER, N.Y.

IMPROVED

Anti-Incrustation Liquid,

For the Prevention and Removal of

SCALE IN STEAM BOILERS.

Is purely a liquid, free from sediment, contains no acid, and is absolutely safe and effective.

Prof. H G. Torrey, of the U. S. Assay Office, says: "Downer's Improved Boiler Liquid is free from all injurious substances, and well adapted to accomplish the object sought; know of nothing better and highly recommend it."

Circulars and references on application.

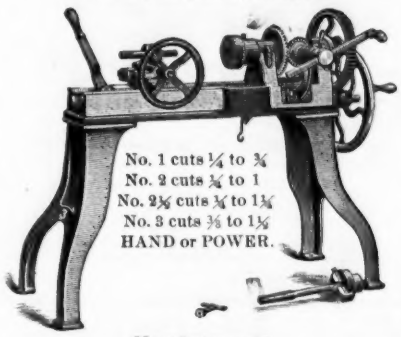
A. H. DOWNER,

PROPRIETOR AND SOLE MANUFACTURER,

17 Peck Slip, - New York.

BOYNTON & PLUMMER,

WORCESTER, MASS.



No. 1 cuts ¼ to ⅜
No. 2 cuts ⅜ to 1
No. 2½ cuts ⅜ to 1¼
No. 3 cuts ⅜ to 1⅝
HAND or POWER.

Manufacturers of

BOLT CUTTERS,

Upright and Horizontal Drills,

For Blacksmiths' and Carriage Makers' Use.

Illustrated Catalogue furnished on application.

A. F. PRENTICE & CO.

Manufacturers of

Light Machinists' Tools.

FOOT POWER LATHES A SPECIALTY.

54 Hermon Street,

WORCESTER Mass.

MACHINISTS' AND FOUNDRY SUPPLIES.

Machinists' Tools, Drills, and Taps and Dies. Also, **Belting and Steam Packing** of all kinds, and a general assortment of supplies for

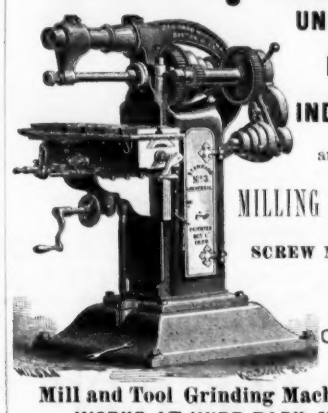
FACTORIES AND MILLS.

T. B. BICKERTON & CO.

No. 12 South Fourth Street,

PHILADELPHIA, PA.

Brainard Milling Machine Co.



UNIVERSAL, PLAIN, INDEX, HAND and all other

MILLING MACHINES,

SCREW MACHINES,

CAM CUTTERS

Mill and Tool Grinding Machines &c.

WORKS AT HYDE PARK, MASS.

Office, 36 OLIVER ST., Cor. Franklin, BOSTON.

PATTERN AND BRAND LETTERS.

PRICES REDUCED.

VANDERBURGH, WELLS & CO.

Printers' and Engravers' Warehouse,

Corner Fulton and Dutch Sts.,

NEW YORK.

L. B. EATON,

TOOL STORE,

No. 11 N. 6th St., Philadelphia.

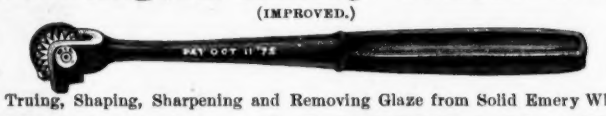
SCROLL SAWS!! SCROLL SAWS!! $3, $5, $8, $11, $13, $15, $21, $22 50. Rogers, Empire, Victor, Lester, Dexter, Challenge, Fleetwood.

TOOL CHESTS!! TOOL CHESTS!! from 75c. to $10.00, containing from 18 to 61 Tools. Carvers, Gravers.

The Huntington Emery Wheel Dresser.

(IMPROVED.)

Invaluable to Users of Emery Wheels.



Thousands in Successful Use

For Truing, Shaping, Sharpening and Removing Glaze from Solid Emery Wheels.

Price $4.00. Send for Circular. **C. E. ROBERTS & CO., CHICAGO, ILL.**

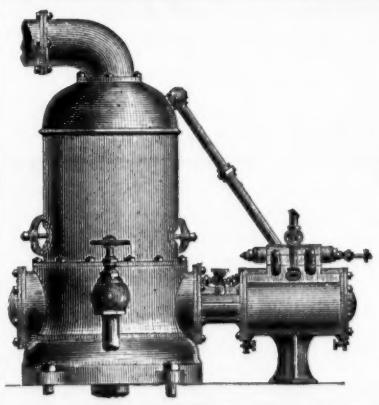
Mills' Directory OF Steam Users IN THE New England States.

Now in course of preparation. A complete Directory of Manufactories, Boiler Owners, and Steam Users in the New England States, carefully compiled and arranged by city and town alphabetically. A limited number of advertisements inserted if received prior to March 10th. Subscription price and advertising rates furnished on application. Address.

THE J. N. MILLS PUBLLSHING CO.

10 PEMBERTON SQUARE, Boston.

165 BROADWAY, New York.



20 Per Cent. Saving in Fuel,

25 Per Cent. Increased Power

BY ATTACHING

HAMILTON'S INDEPENDENT AIR PUMP

AND CONDENSER

TO YOUR ENGINE.

Manufactured only by

SAWTELLE & JUDD,

HARTFORD, CONN.

The Goulds Manufacturing Co.

Manufacturers of all kinds of

Force and Lift PUMPS

For Cisterns, Wells, Railroads, Steamboats, Windmills, etc.

FIRE ENGINES, Hydraulic Rams, AMALGAM BELLS

For Churches, Schools, and Plantations.

Corn-Shellers, Sinks, etc.

Pumps and Materials for Driven Wells a specialty.

Satisfaction guaranteed.

Catalogues furnished upon application.

INQUIRE FOR GOULDS PUMPS

FACTORY, SENECA FALLS, N. Y.

WAREHOUSE, 15 PARK PLACE, NEW YORK CITY

POOLE & HUNT, BALTIMORE.

MANUFACTURERS OF

THE POOLE & HUNT LEFFEL TURBINE

WATER WHEELS,

MACHINE MOULDED MILL GEARING,

SHAFTING, PULLEYS AND HANGERS,

STEAM ENGINES AND BOILERS,

MIXERS FOR FERTILIZERS AND CHEMICALS.

HOISTING MACHINERY and ELEVATORS

Safe, Durable and reasonable in price.

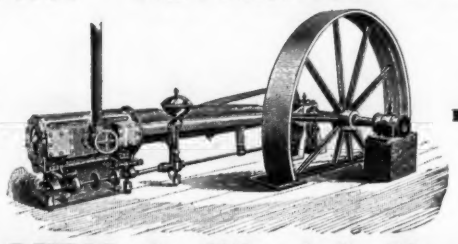
FRICTION CLUTCH PULLEYS AND CUT OFF COUPLINGS.

We manufacture the "Giant Friction Clutch Pulley," known as the "Captain." Is the **Best in the World** for connecting the gearing of callender rolls, hoisting coal, logs or freight. Our Clutch can connect any amount of power, at any speed, without slacking the motive power in the least, and gives no shock, is easy to ship and unship, in *fact* this is the only Clutch that can do heavy work satisfactorily.

D. FRISBIE & CO., New Haven, Conn.

THE "BROWN" AUTOMATIC CUT-OFF ENGINE.

UNEXCELLED FOR **WORKMANSHIP, ECONOMY** AND **DURABILITY.**



WRITE FOR PRICES AND INFORMATION.

C. H. BROWN & CO., Sole Manufacturers,
FITCHBURG, MASS.

THE
LAWRENCE ENGINE,

A FIRST-CLASS AUTOMATIC CUT-OFF STATIONARY

ENGINE.

Highest Economy. *Best Workmanship at a Moderate Price.*

ARMINGTON & SIMS, - LAWRENCE, Mass.

JARVIS PATENT FURNACE

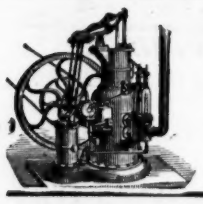
FOR SETTING

STEAM BOILERS.

Economy of Fuel, with increased capacity of Steam Power.
The same principle as the SIEMENS' PROCESS OF MAKING STEEL, utilizes the waste gases with hot air on top of the fire.
Will burn all kinds of waste fuel without a blast, including screenings, wet peat, wet hops, sawdust, log-wood chips, horse manure, &c.

A. F. UPTON, General Agent.

Also Agent for the Mahony Patent Corrugated Grates, with 50 per cent. air space.
Send for Circular. *P. O. BOX 3401, BOSTON, MASS.*



AIR ENGINES.

NO WATER. NO ENGINEER.

No Extra Insurance ! Absolutely Safe ! Simple ! Reliable ! Durable !
Most Convenient and Economical Power Known.

SHERRILL ROPER AIR ENGINE CO.

Manufacturers of Air Engines, Elevators and Hoisting Machinery.

91 & 93 Washington St., N. Y.

W. H. HOFFMAN, M. E.,
PASSAIC, New Jersey.

Designer and Constructor of
Hawser and Rope Machinery
Working Drawings of Engines, Boilers, Machinists' and Boiler Makers' Tools.

Betts Machine Co.
WILMINGTON, DEL.
Have on hand a large lot of
NEW AND SECOND HAND
Machine Tools.

WHITTIER MACHINE CO.
MANUFACTURERS OF
STEEL BOILERS,
Steam Engines and Elevators,
Boston, Mass.: Works, 1176 Tremont St.
N. Y. Office, 120 Broadway.

STEELINE.

Used for refining and tempering all kinds of Steel Tools.
Increases their durability at least five-fold.
Secures absolute safety from cracking.
Send for Circular to

BAUER & CO., 96 Greenwich Ave., N. Y.

THE
Waters' Perfect Governor,

WITH AUTOMATIC SAFETY STOP, ADJUSTABLE SPEED,
SOLID COMPOSITION VALVES AND SEATS.

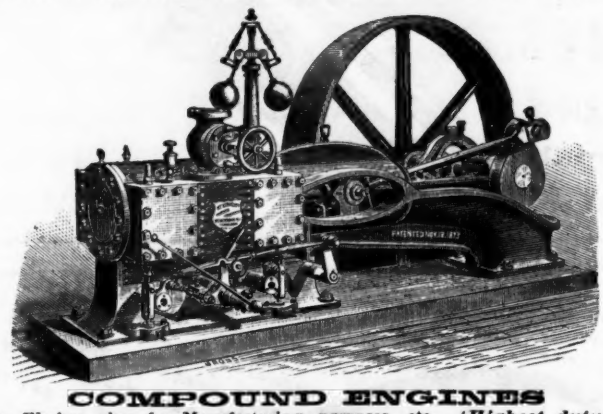
EVERY GOVERNOR IS WARRANTED.

WILLIAM COOKE,
(Successor to COOKE & BEGGS),
AGENT.
6 Cortlandt Street, - New York, N. Y.

A FULL LINE ALWAYS IN STOCK.

Patent Automatic Cut-off Steam Engine.

WM. WRIGHT,
PATENTEE AND BUILDER, NEWBURGH, N. Y.
THE MOST ECONOMICAL IN THE USE OF FUEL, THE SIMPLEST IN CONSTRUCTION, AND ALTOGETHER THE BEST CUT-OFF ENGINE IN THE MARKET.



COMPOUND ENGINES
For City Water Works; also for Manufacturing purposes, etc. (*Highest duty guaranteed.*)
MARINE AND STATIONARY ENGINES.
STEAM BOILERS AND TANKS,
LIGHT AND HEAVY FORGINGS, SHAFTING, PULLEYS, HANGERS, MILL WORK, IRON AND BRASS CASTINGS, &c.
A LARGE GENERAL ASSORTMENT OF PATTERNS ON HAND.

SIZES and PRICES.

VERTICAL.

NAME.	Horse Power.	PRICE.
Mercury	10	$250
Queen	15	275
Monarch	20	325
Vulcan	30	400
HORIZONTAL		
Meteor	10	$250
Reliable	20	325
Hercules	30	400

A NEW DEPARTURE.
VERTICAL AND HORIZONTAL ENGINES AND YACHT ENGINES
OF FROM 10 TO 30 H. P.
At a Reduction of Fifty Per Cent. from Former Prices.
BEST MATERIAL. BEST WORKMANSHIP. LOWEST PRICES.
Manufactured by HEALD, SISCO & CO., Baldwinsville, N. Y.

Send for new Illustrated Circular, giving full description, and convincing testimonials, of which the following is a specimen:

U. S. ENGINEER'S OFFICE,
PITTSBURGH, Pa., July 23, 1879.

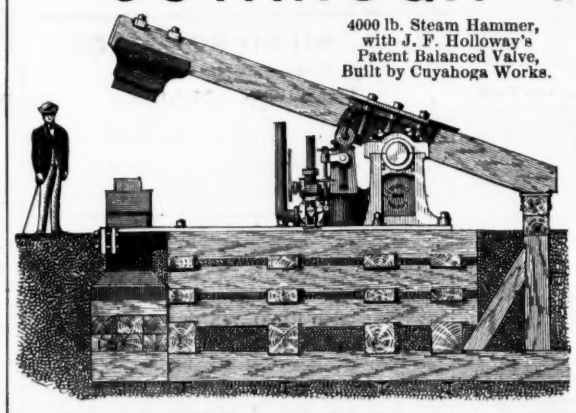
Messrs. HEALD, SISCO & Co., Baldwinsville, N. Y.

Gentlemen:—In reply to your letter of the 19th instant, I have to say that we have had one of your "Reliable" horizontal engines at work since the middle of October, 1878, up to the present time. It has been used for driving one of your No. 10 Centrifugal Vertical Pumps, and has given us entire satisfaction. The only repairs necessary has been the replacing of the piston packing once.

Yours truly,
T. A. MAHAN,
1st Lieut. Engineers.

[We desire to call particular attention to the above letter, as since it was received by us, Lieut. Mahan has confirmed his good opinion of our Engines therein expressed, by ordering two more of them.]

CUYAHOGA WORKS



4000 lb. Steam Hammer, with J. F. Holloway's Patent Balanced Valve, Built by Cuyahoga Works.

Manufacturers
LAND
AND
MARINE ENGINES,
BLAST FURNACE
Machinery,
STEAM
Hammers

Send for Circulars.

Cleveland, Ohio, U. S. A.

LATHE ATTACHMENTS
FOR MILLING,
Plane and Irregular Forms.

Taps and Reamers Fluted and Gears cut without removing from the lathe centers.

See American Machinist, Sept. 13 and 20.
For circular address WM. MAIN, Piermont, N. Y.

JOHN FISH, M. E.
Room 23, 8 & 10 Pine Street,
(Of the Pneumatic Tramway Co.) New York City.

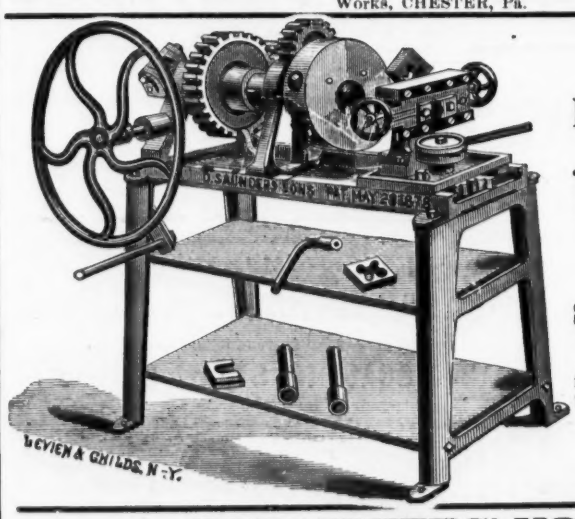
Special attention given to Designing and Superintending the Construction of Improved Machinery.
Hoisting Engines, Air Compressors, and Pneumatic Motors a Specialty.
Working Drawings and Plans, Specifications and Estimates furnished.

STEEL CASTINGS

FROM 1-4 TO 10,000 LBS. WEIGHT.

True to pattern, sound and solid, of unequaled strength, toughness and durability. An invaluable substitute for forgings or cast iron requiring three-fold strength.
Gearing of all kinds, Shoes, Dies, Hammerheads, Crossheads for Locomotives, etc. 12,000 Crank Shafts of this steel now running proved superior to wrought iron.
CRANK SHAFTS, CROSSHEADS and GEARING specialties.
Circulars and Price Lists free. Address

CHESTER STEEL CASTINGS CO.
Formerly McHaffie Direct Steel Castings Co.
Works, CHESTER, Pa. 407 Library St., PHILADELPHIA.



D. SAUNDERS' SONS
New Pipe-Threading Machine
The I.X.L.
FOR HAND OR POWER.
Manufacturers of
Steam & Gas Fitters' Tools.

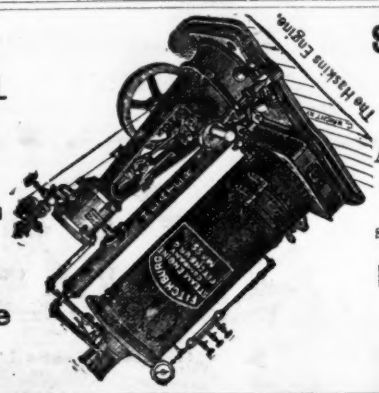
Pipe Cutting and Threading Machines for Pipe Mill Use, &c., a Specialty.

YONKERS, N. Y.
SEND FOR CIRCULARS.

PUBLISHERS' NOTICE.

The increasing pressure of advertisements upon our strictly limited space has crowded out our own column announcement. Drop a postal for circular containing selected list of "Practical Articles" by **Forty-Five** of the best mechanical writers in this country, which have been contributed to the AMERICAN MACHINIST from time to time. **AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.**

HORIZONTAL.
VERTICAL
Automatic Cut-off
ENGINES.
Yacht Engines,
Semi-Portable Engines.



STEEL AND IRON BOILERS.

All sizes to 225 horse-power.

Send for pamphlet and say where you saw this.

FITCHBURG STEAM ENGINE CO.
Fitchburg, Mass.

THE·STOW·FLEXIBLE·SHAFT·CO·LIMITED·

As this shaft transmits power through any number of curves, its value in the railroad and general machine shop, is at once apparent. We have designed, and keep in stock, a series of special tools for use with the shaft, as: PORTABLE DRILLS for metals; AUGER CHUCKS for wood; CLAMPS for emery and buffing wheels, etc. CATALOGUE and PRICE LIST, on application.

500·NORTH·FIFTEENTH·ST·PHILADELPHIA·

H. L. STELLWAGEN, Mechanical Engineer, 254 N. 5th St., Philadelphia.

THE FAR-FAMED **AMERICAN LUBRICATOR.** TEN THOUSAND IN USE.
SEND FOR PAMPHLET.
AMERICAN LUBRICATOR CO.
DETROIT. MICH. U.S.A.

IMPORTANT TO STEAM USERS.
Great Saving of Fuel.
Save repairs and prevent explosion by using the
Peerless Damper Regulator,
which regulates the draft automatically, and controls the steam pressure. In ordering mention pressure. Illustrated Catalogue sent on application.
Price, $38.50.
AMERICAN STEAM APPLIANCE CO.
SOLE MANUFACTURERS,
28 School Street, BOSTON. *13 and 15 Park Row,* NEW YORK.

BOOKS FOR SALE.

Rare opportunity to purchase a complete set of the "Encyclopedia Britannica," 8th edition. Twenty-three books, bound in cloth, at $55.00. Also, a copy of The Practical Draughtsman's Book of Industrial Design, from the French, Armengand. By William Johnson, C.E.; 1860, in good condition, cloth, at $7.00. Address, J. F., Office American Machinist, 96 Fulton Street, New York.

A PRACTICAL TREATISE
ON THE
COMBUSTION OF COAL,
Including Descriptions of various Mechanical Devices, for the Economic Generation of Heat by the Combustion of Fuel, whether SOLID, LIQUID, OR GASEOUS.
BY
WILLIAM M. BARR.
1 Vol., large 8vo., illustrated.
Price, Extra Cloth, - - - - - $2.50
" Half Morocco, - - - - - 3.50
Sent, postage paid, to any part of the United States upon receipt of the price. Address
JOHN BROTHERS, Publishers, Indianapolis, Ind.

GEO. C. TRACY & CO
Counselors at Patent Law
EUCLID AVE. BLOCK,
CLEVELAND, O.
Before doing anything in regard to Patents, send for our 140 page book, "**ALL ABOUT PATENTS,**" mailed free.

Back Numbers Wanted.

We will allow **FOUR MONTHS'** Subscription to any one sending us a clean copy of any of the following back numbers of the **American Machinist:**

Vol. I, No. 1. (November, 1877.)
Vol. I, No. 2. (December, 1877.)
Vol. I, No. 3... (January, 1878.)
Vol. II, No. 2.. (December, 1878.)
Vol. II, No. 4.. (February, 1879.)

American Machinist Publishing Co.
96 Fulton Street, New York.

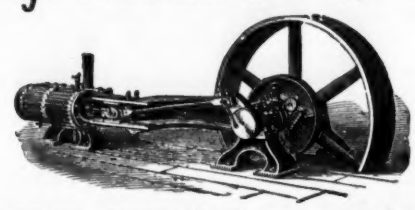
A. J. WILKINSON & CO.
186 & 188 Washington Street,
BOSTON, MASS.
Machinists' Tools & Supplies,
CUT BRASS GEARS.
CATALOGUES FREE.

SECOND-HAND
Machinists' Tools.

One 23 x 48 in. **Corliss Engine.**
One Engine Lathe, 90 in. x 20 ft. Ames. New.
One Engine Lathe, 37 in. x 24 ft. Pond. Good as new.
One " " 36 in. x 12 ft. Ames. New.
One Engine Lathe, 30 in. x 20 ft. Good order.
One Engine Lathe, 30 in. x 16 ft.. Wheeler, new.
One " " 26 in. x 14 ft. " "
One " " 26 in. x 13 ft., very heavy.
One " " 26 in. x 12 ft. New.
One " " 21 in. x 14 ft. Pond, good as new.
Five " " 26 in. x 10 ft. New.
One " " 20 in. x 6 ft. Wheeler.
One " " 19 in. x 7 ft. Whitcomb.
One " " 16 in. x 8 ft. Wheeler.
One " " 15 in. x 6 ft.
One " " 24 in. x 12 ft. Not Screw Cutting.
One large Chucking Lathe and Chuck.
One Hand Lathe, 18 in. x 4½ ft.
Two " " 20 in. x 8 ft.
12 " " 11 in. x 4½ ft. New Spencer.
Six " " 7 in. x 2½ ft. " "
One Planer, 30 in. x 6ft. Wheeler. Good order.
One Planer, 52 in. x 10 ft. Pond. New.
One Planer, 27 in. x 8 ft. Good order.
One " 26 in. x 7 ft. Niles. New.
One " 22 in. x 5 ft. Wheeler. New.
One Crank Planer, 24 in. stroke.
One 8 in. stroke Shaper. Gould.
One 8 in. " " Pratt & Whitney.
One 15 in. " " Hendey.
One No. 3 Garvin Milling Machine.
One Garvin Cutter Grinder. New.
One Combined Cutter and Reamer Grinder, with Threading Tool Grinder attached. New.
One 27 in. Swing Upright Drill. New Bk. Geared and Self-feed.
Three 24 in. " " " Ames.
One 24 in. " " " P. & W. Self-feed.
One 20 in, " " " Prentiss, new.
One 10 in. " " " Blaisdell.
One Gear Cutter.
One each No. 0 P. & W. 2 and 3 Spindle Drills.
One each No. 1 P. & W. 3 and No. 2, 4 Spindle Drills.
Three Sensitive Drills, drills to 3-16 in. hole.
One No. 4 Stile's Punch Press. A 1 order.
One No. 1 Wilder Punch Press. New.
One No. 3 " " " Geared. New.
One No. 4 " " " Geared. New.
One No. 6 " Shear. Geared.
One No. 1 Wilder Bar Iron Cutter. New.
One No. 3 " " " " "
One 10 H. P. Baxter Engine.
Seven Stephens' Vises.
Belting, Shafting and Miscellaneous Machinery.

E. P. BULLARD,
14 Dey Street, New York.

The Buckeye Automatic Cut-off Engine.



Estimates Furnished on Application.
BUCKEYE ENGINE CO.
Room 42, Coal and Iron Exchange, New York.
HILL, CLARKE & CO., - - - 36 & 38 Oliver Street, Boston.

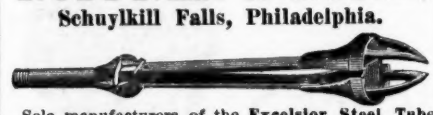
The George Place Machinery Agency

Offer FOR SALE a large lot of SECOND HAND LATHES, PLANERS, DRILLS, Etc., at low prices.

Send for a List.

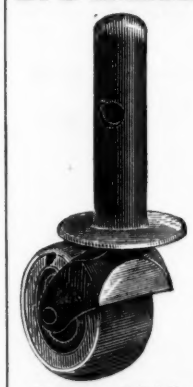
The George Place Machinery Agency,
121 Chambers & 103 Reade Sts., New York.

RUFFNER & DUNN,
Schuylkill Falls, Philadelphia.



Sole manufacturers of the **Excelsior Steel Tube Cleaners.** Price, $1.00 per inch. Send for Circular containing names of users who consider it indispensable

GEORGE P. CLARK,
Manufacturer of the Patent
RUBBER CASTOR.



SECTIONAL VIEW.

The only Solid Socket Castor in the market. No more noise. No more marking of inlaid floors. Save your carpets by using the Rubber Castor. Warranted perfect in action. Also one of the best non-conductors for Rheumatism. Want to be used to be appreciated. Once tried always liked.
GEORGE P. CLARK, Windsor Locks, Ct.

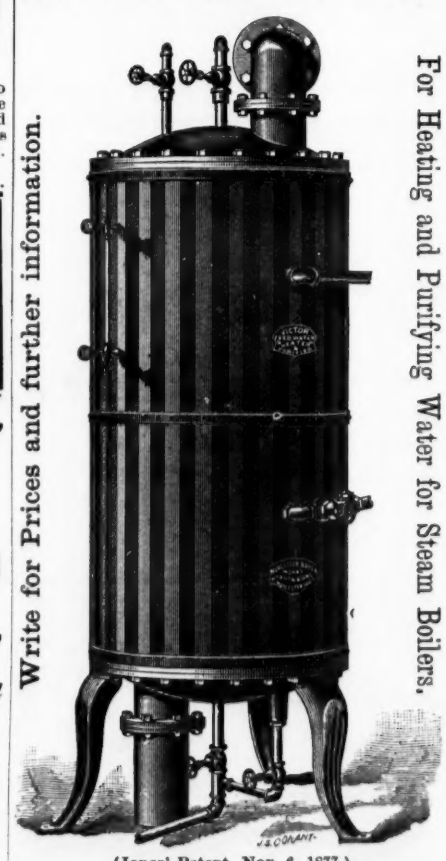
CHARLES MURRAY.
ENGRAVER ON WOOD.
No. 58 ANN ST.
NEW YORK.

F. W. MOSS,
80 John Street, New York,
(Successor to Joshua Moss and Gamble Bros.,)
Steel and Files,
HAMMERS, ANVILS, VISES AND BLACKSMITHS' TOOLS.
WARRANTED CAST STEEL,
Specially adapted for Dies, Punches, Turning Tools, Drills, &c. Also
Improved Mild-Centred Cast Steel
For Taps, Reamers, Milling Tools, &c.

Warranted not to crack in hardening Tools of any Size.

AMERICAN WATCH TOOL CO.
WALTHAM, MASS.
MANUFACTURERS OF
SPECIAL TOOLS and MACHINERY OF ALL KINDS.
INCLUDING
Watch and Clock-Making Machinery.

WORCESTER BOILER WORKS,
MANUFACTURERS OF THE
"VICTOR"
Feed-Water-Heater and Purifier.

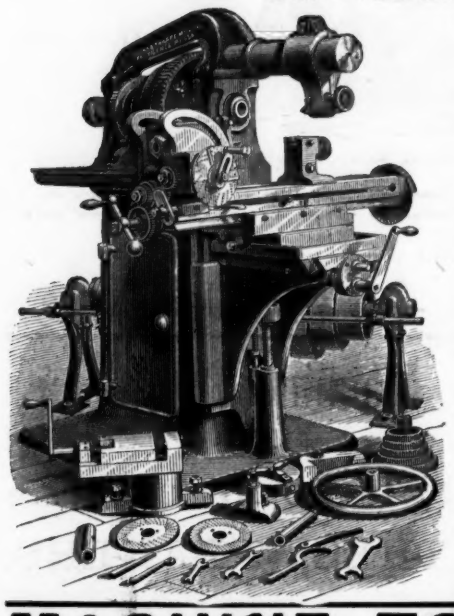


For Heating and Purifying Water for Steam Boilers.
Write for Prices and further information.
(Jones' Patent, Nov. 6, 1877.)
WM. ALLEN & SONS.
WORCESTER, MASS

BROWN & SHARPE M'F'G CO.

PROVIDENCE, R. I.

MANUFACTURERS OF THE



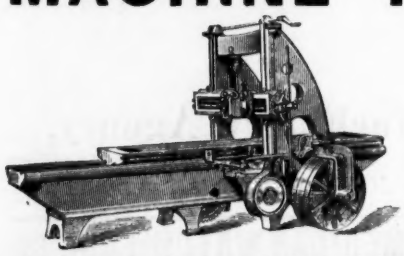
UNIVERSAL
Milling Machine

This Machine has been designed especially to meet the wants of Steam Engine and Locomotive builders, and others engaged in the manufacture of heavy machinery and tools.

The essential features and motions are the same as in our smaller Universal Milling Machine, with such enlargement of the whole machine and its parts as would best adapt it for the class of work to be done. The cone has three diameters, each 3⅛ inches face. In addition, the cone is strongly geared, thus making six changes of speed. There are, also, the same number of changes of feed. The spindle boxes are of hardened cast steel, and, together with the spindle bearings, are carefully ground, and are provided with means of compensation for wear. The spindle will carry a cutter arbor projecting 15 inches, which is supported by an adjustable center at the outer end. Cutters of 8 inches or less diameter can be used. The horizontal movement of the spiral clamp bed upon the knee, in a line with the spindle of the machine, is 6½ inches, and the vertical movement of the spiral bed centers below the spindle centers is 11 inches. The spiral bed can be set at angles of 35° each way from center line of spindle, and can be fed automatically 22 inches, taking also 22 inches between the centers, and will swing 11⅛ inches.

☞ Illustrated Catalogue sent per mail on application.

MACHINE TOOL WORKS,



FORMERLY

FERRIS & MILES,

Twenty-fourth and Wood Streets

(Take Arch or Vine Street Car),

FRED'K B. MILES, Engineer. PHILADELPHIA

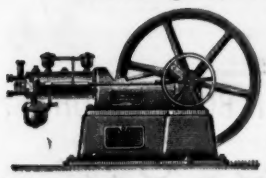
MACHINE TOOLS, STEAM HAMMERS, &c.

Having introduced many novel and valuable improvements into the construction of **SHAPING, SLOTTING, BORING** and **PLANING MACHINES**, as well as **Lathes** and **Drills**, we are now prepared to furnish these machines in greater perfection than ever before. By means of our improved devices the operations of turning, drilling, boring, planing and shaping, or slotting, can all be performed with a great saving of time and labor. It will be found worth any purchaser's while to examine our new methods of screw cutting, feed-gearing and convenient arrangements and attachments for enabling work to be done with the least possible expenditure. We would direct special attention to our new **4 FT. RADIAL DRILL**, with **6 Automatic Feeds, 10 IN. STROKE SHAPING MACHINES, 17 IN. SQUARE PLANING MACHINES** and **PATENT SCREW CUTTING LATHES**, which cut 16 threads and give 16 feeds **without changing gears. Send for Catalogue.**

FRED'K B. MILES.

NEW OTTO SILENT GAS ENGINE.

Working without Boiler, Steam, Coal, Ashes or Attendance.



STARTED INSTANTLY BY A MATCH, IT GIVES FULL POWER IMMEDIATELY.

WHEN STOPPED, ALL EXPENSE CEASES.

No Explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running. Recommended by Insurance Companies.

UNSURPASSED IN EVERY RESPECT for Hoisting in Warehouses, Printing, Ventilating, Running small Shops, etc.

2, 4 and 7 H. P. and upwards. Built by

SCHLEICHER, SCHUMM & CO., 3045 Chestnut St., Philadelphia.

Boston Agency, HILL, CLARKE & CO., 36 & 38 Oliver Street.

STEAM
Pumping Machinery

For Feeding Steam Boilers, Filling Reservoirs and Tanks, and for General Pumping.

SEND FOR CATALOGUE

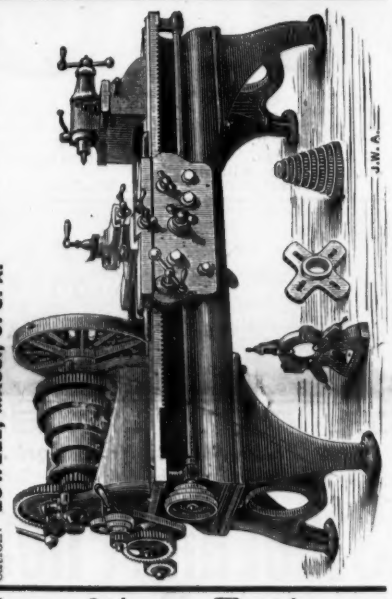
Illustrating every variety of

STEAM PUMPING MACHINERY.

Cope & Maxwell M'f'g Co.

HAMILTON, OHIO.

GEO. W. FIFIELD, manufacturer of **ENGINE LATHES** from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application. **LOWELL, MASS., U. S. A.**



Machines at reduced prices, and Wheels *Guaranteed.*

LEHIGH VALLEY EMERY WHEEL CO.

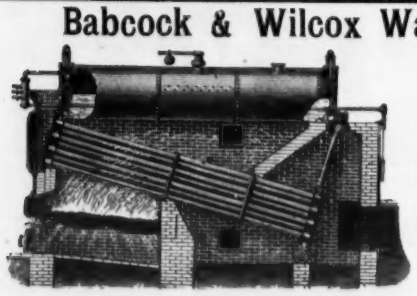
Send for our new Illustrated Catalogue

Weissport, Penn.

JAMES W. SEE, Consulting Engineer,

HAMILTON. OHIO.

Babcock & Wilcox Water-Tube Steam Boiler,



Over 40,000 Horse-Power Now in Use. Adapted for all purposes. Safety from Explosions.

In sections easy of transportation. No bolted, screwed or packed joints. All joints made by expanding wrought iron tubes into bored holes. Can be erected or repaired by ordinary mechanic. Easily cleaned from soot or sediment. Adapted to all kinds of fuel. Steady water line and dry steam. No leaks from unequal expansion. Rapid steaming. Highest attainable economy. Centennial Exposition Medal awarded this boiler for highest economy and efficiency on test.

Illustrated Circulars and other desired information promptly furnished.

BABCOCK & WILCOX, Engineers, 30 Cortlandt St., New York.

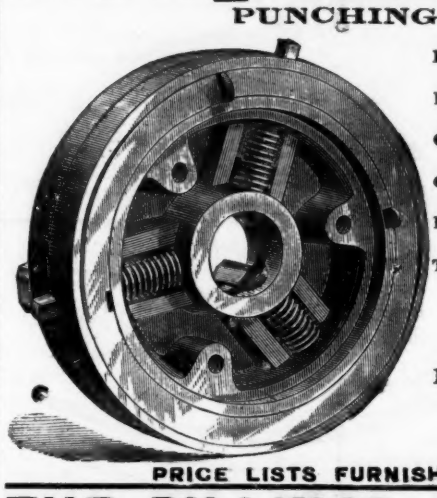
THE PRATT & WHITNEY CO.

HARTFORD, CONN., U. S. A.

MAKE SPECIALTIES OF

Drop Hammers,

PUNCHING PRESSES,



HAND DRILLING MACHINES, RATCHET DRILLS, COMBINATION LATHE CHUCKS, CUTTERS FOR TEETH OF GEAR WHEELS, SCREW PLATES, HAND, MACHINE NUT AND PIPE TAPS, AND BOLT CUTTERS,

In connection with their business of

MACHINISTS' TOOLS, GUN, SEWING MACHINE and Special Machinery, &c.

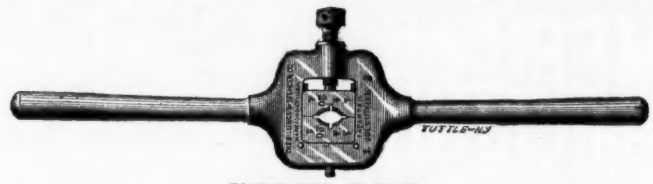
PRICE LISTS FURNISHED ON APPLICATION.

THE BILLINGS & SPENCER CO.

HARTFORD, CT., U. S. A.

Manufacturers of Billings' Patent Screw Plates in Four Sizes.

These Plates are Drop-forged from Siemens-Martin Steel. The Dies are made of best Tool Steel.



PRICE LIST.

No. 0.

With Dies and Tap, Cutting
1-8[48] 5-32[40] 3-16[32] 7-32[24] 1-4[20].....$5.25
The same, Nickel-plated, in Leather-covered Case, lined with Plush 6.50
Single pair of Dies, each..... .50
Machinists' or Blacksmiths' Taps furnished to correspond with Dies for Nos. 1, 2 and 3 Plates, at lowest market prices.

No. 1.

With 5 Pairs of Dies, Cutting
1-4[20] 5-16[18] 3-8[16] 7-16[14] 1-2[13].....$7.00

No. 2.

With 5 Pairs of Dies, Cutting
1-2[12] 9-16[12] 5-8[11] 11-16[11] 3-4[10].....$10.00

No. 3.

With 5 Pairs of Dies, Cutting
13-16[10] 7-8[9] 15-16[9] 1[8] 1,1-8[7]..... 15.00

Single Pairs of Dies for No. 1 Plate, $1.00; No. 2 Plate, $1.50; No. 3 Plate, $2.00 each.

Different sizes and number threads furnished.

Special prices quoted on Whitworth or U. S. Standard Threads on application.

Steel and Iron Drop-forgings of every description for Guns, Pistols, Sewing Machines, Machinists' Tools and Machinery generally. Send for Illustrated Catalogue and Price List.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

J. M. ALLEN, PRESIDENT.

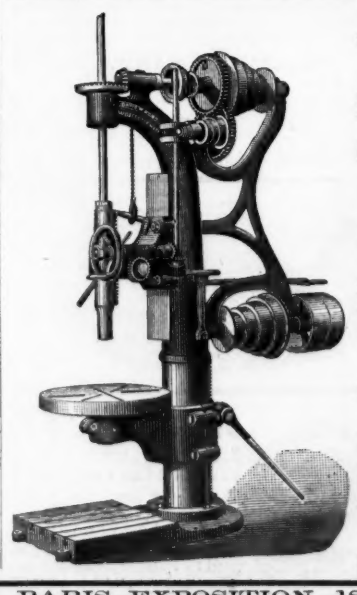
W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY

GEO. B. GRANT, 100 BEVERLY ST. BOSTON, KEEPS A STOCK OF SUPERIOR CUT GEARS FOR MODELS AND LIGHT MACHINERY, AND CUTS GEARS TO ORDER OF ANY KIND OR SIZE, IN IRON OR BRASS—SEND FOR LIST—HE HAS FACILITIES FOR MAKING MODELS AND LIGHT MACHINERY, AND PAYS SPECIAL ATTENTION TO ORDERS BY MAIL.

Monitor Binders FOR THE American Machinist,

$1.00 EACH BY MAIL OR EXPRESS.

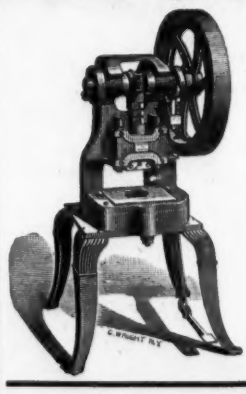


Engine Lathes, Planers, Drills, &c.

DAVID W. POND, WORCESTER, MASS.

Send for Catalogue of New Designs.

GOLD MEDAL AWARDED, PARIS EXPOSITION, 1878.



BLISS & WILLIAMS,

Plymouth, Pearl and John Streets,

BROOKLYN, N. Y.

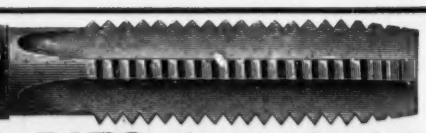
Manufacturers of all kinds of

Presses, Dies and Special Machinery

FOR WORKING SHEET METALS, &c.

FRUIT AND OTHER CAN TOOLS.

J. M. CARPENTER PAWTUCKET, R.I.



Manufacturer of **TAPS AND DIES** of every description.

Also, for sale low, **UNITED STATES STANDARD GAUGES**, from ¼ to 3 inch.